Week (2)

1)summary

There is a type of heat transfer which is called convection. when the fluid is heated, it moves from the source.

There are two kind of convection:

1st)natural: it happened as as a result of density difference. The convection goes from heavier density to lighter one.

Second)forced convection: there is the external force like the wind

The rate of heat transferred through convection depends on 3 different items:

1-Kind of liquid or gas

2-Velocity of liquid or gas

3-Temperature difference

H is not depend on material and kind of surface, it depends on speed of transfering.

Inside the house which there is no air flow H is natural, but outside of house we have to consider the worst condition, like the coldest day and windy day.

The result of examples in class:

Resistance of glass is less than others,

The glass in useless,even if we change its thickness,there would be no difference.the increase in thickness of glass is just waste of money.

Despite the useless effect of glass,we cannot decrease the thickness of it less than 8 mm(standard between 6-13),because of its impact resistance and wind.

If we use air between glasses the Q will be decrease(for instance in the example in the class by using 10 mm air the Q was decreased 4 time .

Q and R are useful for calculating the size of heating systm.

2)mistake

The mistake of numbers was as aresult of one number missed in calculation.

3)solve

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°CC) separated by a 13-mm-wide stagnant air space(k=0.026 W/m°CC).

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 the window to be h1=10$WWmm$2°CC and h2=40$WWmm$2°CC, which includes the effects of radiation.)

A = 0.8mm∗ 1.5mm=1.2mm^2

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

$$R_{conv_2} = \frac{1}{h_1 \times A} = (\frac{1}{40 * 1.2}) = 0.0208\ ^\circ C/W$$

$$R_{glass} = \frac{L_g}{(K_g \times A)} = \frac{0.006}{0.78 * 1.2} = 0.0064\ ^\circ \frac{C}{W}$$

$$R_{air} = \frac{L_{air}}{(K_{air} \times A)} = \frac{0.013}{0.026 * 1.2} = 0.4167\ ^\circ \frac{C}{W}$$

$$R_{total=}\ 0.5333\ ^\circ \frac{C}{W}$$

$$\dot{Q}_{conv} = \frac{30}{0.5333} = 56.25\ W$$

$$\dot{Q} = \frac{T_{inff_1} - T_{s_1}}{R_{conv_1}} \rightarrow 56.25 = \frac{20 - T_{s_1}}{0.0833} \rightarrow T_{S_{1=}}\ 15.3\ ^\circ C$$