ASSIGNMENT WEEK 2

A. Short summary on Convective Heat Transfer:

Convection is termed as the heat transfer in fluids (liquids and gases). It can be done by using solid as a medium. For e.g. - heat exchange from the outside of a room to inside using wall as a medium. We have 2 types of concvections – Forced and Natural

The rate of convective heat transfer depends on:

1. Difference in temperature
2. Velocity of molecules of the air or liquid
3. Nature of the air or liquid

Newton's Cooling Law states that the rate of convection of a material is inversely proportional to the resistance(R) of a material and directly proportional to the area(A) of the material.

$$Q_{conv.} = hA(Ts - T\infty)$$

Where,
h = Homogeneous Temp of the room (variable due to Velocity of air molecules)

A= Area of the surface

Ts= Temperature of the surface

T∞= Temperature inside the room

Increasing the thickness of a single glass pane increases the Resistance (R), but this change is very low, hence it is considered negligible. Also R is directly proportional to the Area of the glass, whereas increasing the area to that extent will involve in increasing the thickness for safety and hence it is not feasible.

B. Mistakes made During the class:

I made a mistake of unit conversion from millimetres to meters. Also I did not Calculate R_{total} separately, instead I did it all together.

C. Double pane window with with the air-gap thickness of 13 mm and glass thickness of 6 mm,

$$\therefore R_{conv1} = \frac{1}{h_1 A} = \frac{1}{10 * 0.8 * 1.5} = 0.0833 \frac{℃}{W}$$

$$\therefore R_{conv2} = \frac{1}{h_2 A} = \frac{1}{40 * 0.8 * 1.5} = 0.0208 \frac{℃}{W}$$

$$\therefore R_{wall1}\, x\, 2 = \frac{L_1}{k_1 A} = \frac{0.006}{0.78 * 0.8 * 1.5} = \frac{0.006}{0.936} = 0.0064\, x\, 2 = 0.0128 \frac{℃}{W}$$

$$\therefore R_{wall2} = \frac{L_2}{k_2 A} = \frac{0.013}{0.026 * 0.8 * 1.5} = \frac{0.006}{0.0312} = 0.1923 \frac{℃}{W}$$

$$\therefore R_{total} = R_{conv1} + R_{conv2} + R_{wall2} + R_{wall\ 1}$$

$$\therefore R_{total} = 0.0833 + 0.0128 + 0.1923 + 0.0208$$

$$\therefore R_{total} = 0.3092 \frac{℃}{W}$$

$$\therefore \dot{Q} = \frac{T_{\infty 1} - T_{\infty 2}}{R_{total}}$$

$$\therefore \dot{Q} = \frac{20 - (-10)}{0.3092} = \frac{30}{0.3092}$$

$$\therefore \dot{Q} = 97.02\ W$$

Since L is directly proportional to R, hence increasing the cavity will inrease the resistance and heat transfer will decrease. Therefore rate of transfer decreases with increase in cavity and thickness of the glass

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