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15:35

**QUESTION:**

write a summary (in your own words !, (in your own words !!!) about the convective heat transfer (half a a page) and explain why increasing the thickness of a single pane glass does not increase the total resistane
2 write an explanation about what mistakes you made in the class that resulted in wrong answers !!
3 solve the same probelm as that of double pane window with with the air-gap thickness of 13 mm and thickness of 6 mm, commment on your results and explain why we have an optimal range for the air-gap's distance !

**SUMMARY:**

- **Convection;** is a kind of heat transfer which occured between solid surface and fluid.It consists of temperature differences in the fluid or between the fluids boundary surface, and the effect of this difference on the density. Convection is one of the heat transfer types.
  There are two types of convection ;

  **1 -** Forced Convection,

  **2-** Natural Convection,

- **Forced Convection**, occurs when fluid movement has an external effect (such as a fan).For example ; When we blow to cool your food, we use forced convection.

- **Natural Convection,** It is the transfer that occurs as a result of the movement of the fluid ,due to existing temperature differences in the fluid.The basic principle of natural convection is that the heated fluid rises and the cooler fluid moves down. For example; it is natural convection that the warmed hot air rises upwards from the radiator surface.

  *why increasing the thickness of a single pane glass does not increase the total resistane?*

  We can explain that ;
  resistance according to the formula;
  It depends on the thickness of the glass, the coefficient value, and the surface area of the glass.
  $R_g = L/ ( k_g * A )$
  So , only the thickness of the glass does not affect the resistance of the glass.The coefficient value, and the surface area of the glass are important values for total resistance. The use of double glazing is a more effective method to increase the total resistance of the glass rather than increasing its thickness.Because with this method, total resistance include two glass resistance and one air resistance.

  $R_{g1} = L/ ( k_g * A )$
  $R_{g2} = L/ ( k_g * A )$
  $R_{airgap} = L/ ( k_g * A )$
  $R_{conv1} = 1/ ( h_1 * A )$
  $R_{conv2} = 1/ ( h_2 * A )$

  $$R_{total} = R_{g1} + R_{g2} + R_{airgap} + R_{conv1} + R_{conv2}$$

- *I am sorry but I was not in class.*

**SOLUTION:**

Consider a 0.8-m-high and 1.5-m-wide double-pane window consisting of two 6-mm-thick layers of 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 $W\ mm2°CC$ and h2 = 40 $WW\ mm2°CC$ , which includes the effects of radiation.)

A= 0.8*1.5 =1.2

$R_{g1} = L/ ( k_g * A ) = 0.006 / (0.78* 1,2) = 0,00641$ C/W

$R_{g2} = L/ ( k_g * A ) = 0.006 / (0.78* 1,2) = 0,00641$ C/W

$R_{airg} = L/ ( k_g * A ) = 0.013 / (0.026* 1,2) = 0,41666$ C/W

$R_{conv1} = 1/ ( h_1 * A ) = 1/(10*1,2)=0,08333$ C/W

$R_{conv2} = 1/ ( h_2 * A ) = 1/ (40*1.2)=0,02083$ C/W

$R_{total} = R_{g1} + R_{g2} + R_{airgap} + R_{conv1} + R_{conv2}$

$R_{total} = 0,00641 + 0,00641 + 0,41666 + 0,08333 + 0,02083 = 0,53364$