Twana Dler Mohsin
stage third - chemical eng
Heat transfer

70

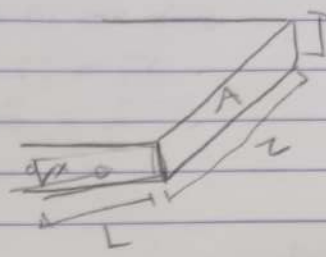
Q1

L = 7.5 cm = 0.075 m
t = 0.003 m

$L_c = L + \frac{t}{2}$ =

$L_c = 0.075 + (\frac{0.003}{2})$

$L_c = 0.0765 m$



$m = \sqrt{\frac{hP}{KAc}}$

$h = 10\ W/m^2.C$
$K_{Cal} = 200\ W/m.C$
$T_1 = 300°C$
$T_2 = 50°C$

$\frac{Ac}{2} = \frac{t}{2} = 0.003 m$

$\frac{P}{2} = \frac{2(2+t)}{2} = 2 * 0.003 = 0.006 m$

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$m = \sqrt{\frac{10 * 0.006}{200 * 0.003}} = 0.1$

$M = \sqrt{hPKAc} * \theta_c$

$M = \sqrt{10 * 0.006 * 200 * 0.003} * (300 - 50)$

$M = 0.1897$

$\frac{q}{2} = M \tanh mL_c = 0.1897 * \tanh(0.1 * 0.0765)$

$\frac{q}{2} = 0.00145\ W/m$

Q2/

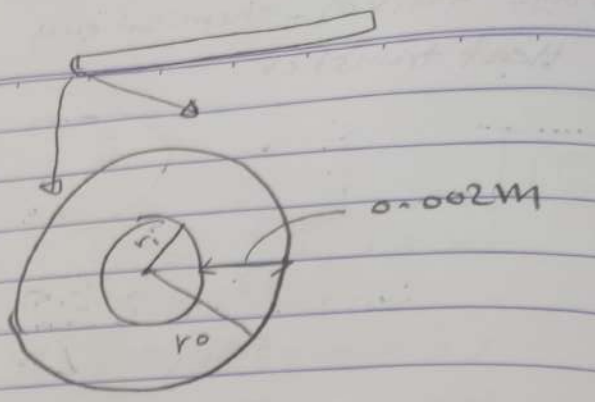
$K_{steel} = 46\ W/m.°C$

$h_i = 1500\ W/m^2.°C$

$h_o = 197\ W/m^2.°C$

$T_i = 223°C$

$T_\infty = 57°C$



$d_i = 3cm = 0.03m$

$r_i = 0.015m$

$r_o = 0.002 + 0.015$

$r_o = 0.017\ m$

$A = 2\pi r L$

$$L * R_{conv1} = \frac{1}{h_i\, 2\pi r_i} = \frac{1}{1500 * 2\pi(0.015)}$$

$$L * R_{conv1} = 0.022\ \frac{°C.m}{W}$$

$$R_{cond} * L = \frac{\ln(r_o/r_i)}{2\pi K} = \frac{\ln(0.017/0.015)}{2\pi * 46}$$

$$R_{cond} * L = 0.000433\ \frac{°C.m}{W}$$

$$R_{conv2} * L = \frac{1}{h_o\, 2\pi r_o} = \frac{1}{197 * 2\pi * 0.017}$$

$$R_{conv2} * L = 0.0475\ \frac{°C.m}{W}$$

$$\frac{q}{L} = \frac{\Delta T}{\sum R} = \frac{223 - 57}{0.022 + 0.000433 + 0.0475}$$

$$\frac{q}{L} = 2373.7\ \frac{W}{m}$$

Q3

$$\frac{q}{A} = k \frac{\Delta T}{\Delta X}$$

$$\frac{400}{1} = \frac{10 \times 500}{\Delta X}$$

$(5000 = 400\,\Delta X) \div 400$

$\Delta X = 12.5\ m$

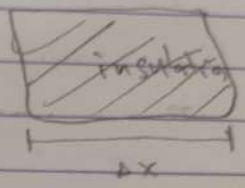
insulation

$K = 10\ W/m \cdot C$

$\Delta X = ?$

$\Delta T = 500°C$

$\frac{q}{A} = 400\ W/m^2$



Q4 Heat is a form of energy that can be transferd from asystem to anothe as aresult of temprature differences.

1. Conduction
2. Convection
3. radiation

① conduction : the transfer of energy from more energetic particles to lower adjacent energetic particles, needs interaction
- mostly works on solids. the temperature is in °C
- needs medium to transfer
- happens cuz of collision & diffusion in fluids and free electrons and vibration of atoms in solids.

② convection : transfer of energy from solid surface to the close fluid in motion.
- needs medium, the T is calculated in °C
- the fluids should move, mostly happens to moved fluids.

③ radiation : the transfer of energ emitted from a surface of mater as electro magnatic waves as aresult of change in electron configeration, needs no medium to transfer, needs difference of temprature.

Q5

$r_o = r_{wire} + \text{thikness of insulator}$

$r_o = 0.0005 + 0.0002$

$\boxed{r_o = 0.0007\ m}$

$d_{wire} = 0.001\ m$

$\text{thikness} = 0.0002\ m$

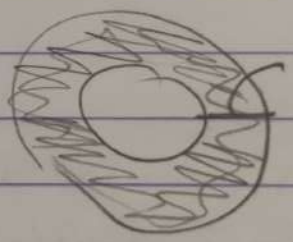
$r_{wire} = 0.0005\ m$

$h = 120\ W/m^2 \cdot °C$

$r_o = \frac{K}{h}$

$K = r_o * h = 0.0007 * 120$

$\boxed{K = 0.084\ W/m \cdot °C}$



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التاريخ: / /

الموضوع:

2-D

$$\left(\frac{\Theta}{\Theta_i}\right)_{total} = \left(\frac{\Theta}{\Theta_i}\right)_{infinit-cylinder} * \left(\frac{\Theta}{\Theta_i}\right)_{infinit-plate} * \left(\frac{\Theta}{\Theta_i}\right)_{semi-infinit\ solid}$$

$$\frac{\Theta}{\Theta_i} = \frac{T - T_\infty}{T_i - T_\infty}$$

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التاريخ: / /

الموضوع:

$$Q \propto A \cdot \frac{dT}{dX}$$

* Heat Diffusion Equation! -

$$\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2}$$

* for Steady-State Heat Conduction: -

$$\frac{\partial T}{\partial t} = 0$$

$$\frac{d^2 T}{dx^2} = 0$$

$$q = \frac{Q}{A}$$

$$q \propto \frac{dT}{dx}$$

* adding thermal conductivity: -

$$Q = -KA \frac{dT}{dx}$$

* the — sigh is for solving the negative sigh of ΔT

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الموضوع : التاريخ / / ٢٠٢

$T_1 = 800^\circ C$

$T_2 = 300^\circ C$

$\frac{q}{A} = 6 \Delta T^4$

$T_1 = 800^\circ C + 273$

$T_1 = 1073 K$

$\frac{q}{A} = 5.669 \times 10^{-8} * (1073^4 - 573^4)$

$T_2 = 300^\circ C + 273$

$T_2 = 573 K$

$\frac{q}{A} = 5.669 \times 10^{-8} * (6.25 * 10^{10})$

$\frac{q}{A} =$

$\frac{q}{A} = 3543 \ W/m^2$

1.5

2.0