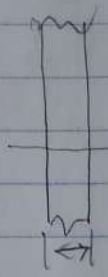
$q_x = \frac{Q_x}{A}$

Conduction HW1.1 7, 16, 25, 29

7.) $L = 4cm$ $\Delta T = 200°C$ $q_x = 500 W/m^2$

$K = ?$

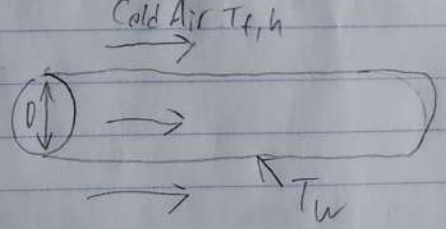


$q = 500 W/m^2$ $q = K\frac{\Delta T}{L} \rightarrow q\frac{L}{\Delta T} = K$ $K = 500\frac{W}{m^2} \cdot \frac{0.04m}{200°C}$

$K = 0.1 \frac{W}{m \cdot °C}$

Convection 16) $T_f = 10°C$ air flows over $D = 2cm$ OD tube, $T_w = 110°C$, $h = 100 W/(m^2 \cdot °C)$, $L = 5m$

$Q = ?$



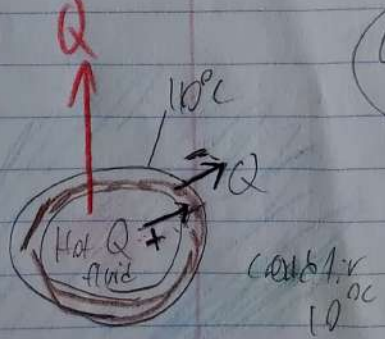
$Q = hA\Delta t$

$D = 2cm = 0.02m$ $r = 0.01m$

Area of tube $= 2\pi rL = 2\pi \cdot 0.01m \cdot 5m = 0.3145 9m^2$

$Q = 100\frac{W}{m^2 \cdot °C} \cdot 0.3145 9m^2 \cdot (110°C - 10°C)$

$Q = 3141.6 W$



Radiation

25) $q = 1000 W/m^2$ absorbs 80% of incident radiation
Amount of energy absorbed by a $4m^2$ area over a period of 2h

$q = 1000 W/m^2$ $\varepsilon = 80\%$ $A = 4m^2$ $t = 2h = 7200s$

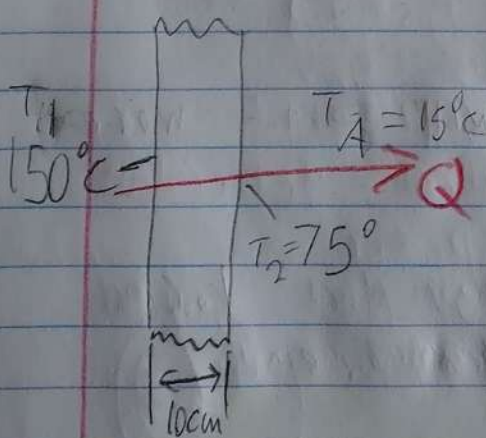
$$q = \frac{Q}{A} \rightarrow Q = qA = 1000 \frac{W}{m^2} \cdot 4m^2 = 4000W$$

Energy absorbed $= Q \cdot \varepsilon \cdot t$
$= 4000W \cdot 0.8 \cdot 7200s$

$E = 23,040,000$
$E = 23.04 MJ$

2a)

$K = 1 \frac{W}{m \cdot °C}$ $L = 10 cm$ $h = ?$



$$q = K \frac{\Delta t}{L} = 1 \frac{W}{m \cdot °C} \frac{150°C - 75°C}{0.1m}$$

$$q = 750 \frac{W}{m^2}$$

$$q = h \Delta t \Rightarrow h = \frac{q}{\Delta t}$$

$$h = \frac{750 \frac{W}{m^2}}{75°C - 15°C}$$

$h = 12.5 W/(m^2 \cdot °C)$