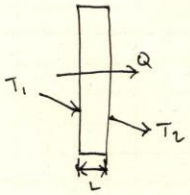
MICHAEL DELAURO
MET 440
HW 1.2

3] GIVEN

$K = 1\ W/(m \cdot °C)$
$T_1 = 1000\ °C$
$T_2 = 400\ °C$
$Q = 2000\ W/m^2$



FIND L

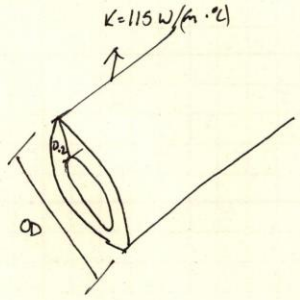
SOLUTION

$$Q = KA\frac{\Delta T}{L} \Rightarrow L = \frac{KA(\Delta T)}{Q} = \frac{1 \times 1 \times (1000 - 400)}{2000} = \boxed{0.3\ m}$$

10] GIVEN

BRASS CONDENSER TUBE
$K = 115\ W/(m \cdot °C)$
$OD = 2\ cm$ $\quad r_o = 1\ cm = 0.01\ m$
$D_i = 2 - 2(0.2) = 1.6\ cm$ $\quad r_i = 0.8\ cm = 0.008\ m$
$h_i = 5000\ W/(m^2 \cdot °C)$
$h_o = 2000\ W/(m^2 \cdot °C)$

$T_1 = 50°C$
$T_2 = 20°C$



a) $$Q = \frac{2\pi L(\Delta T)}{\frac{1}{h_i r_i} + \frac{\ln(r_o/r_i)}{K} + \frac{1}{h_o r^2}}$$

$$= \frac{2\pi L(50-20)}{\frac{1}{5000 \times .008} + \frac{\ln(0.01/0.008)}{115} + \frac{1}{2000 \times .010}}$$

$$= \frac{188.496}{0.025 + 0.00194 + 0.05}$$

$$= \frac{188.496}{0.07694}$$

$$= 2449.9\ W$$

$$= \boxed{2.45\ KW}$$

b) $$Q = \frac{2\pi L(\Delta T)}{\frac{\ln(r_o/r_i)}{K}}$$

$$= \frac{2\pi L(50-20)}{\frac{\ln(0.01/0.008)}{115}}$$

$$= \frac{188.496}{1.940 \times 10^{-3}}$$

$$= 97159.79\ W/m$$

$$= 97.16\ KW/m$$

[7]

GIVEN

$L_1 = 0.3\,m$

$K_1 = 1.5\ W/(m\cdot{}^\circ C)$

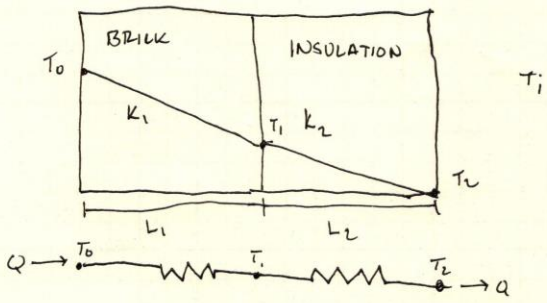
$K_2 = 0.01\ W/(m\cdot{}^\circ C)$

$L_2 = 0.2\,m$

$T_0 = 600^\circ C$

$T_2 = 30^\circ C$

$h = 15\ W/(m^2\cdot{}^\circ C)$



$$\frac{\dot{Q}}{A} = \frac{T_0 - T_2}{\frac{L_1}{K_1} + \frac{L_2}{K_2} + \frac{1}{h_0}}$$

$$= \frac{600 - 30}{\frac{0.3}{1.5} + \frac{0.2}{0.01} + \frac{1}{15}}$$

$$= \frac{570}{20.2667}$$

$$= 13.32\ W/m^2$$

$$\frac{\dot{Q}}{A} = \frac{T_0 - T_2}{\frac{L_1}{K_1} + \frac{L_2}{K_2}}$$

$$13.32 = \frac{600 - T_2}{\frac{0.3}{1.5} + \frac{0.2}{0.01}}$$

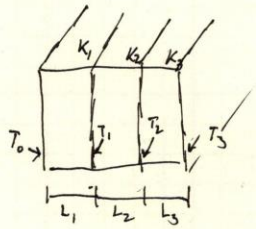
$$13.32 = \frac{600 - T_2}{20.2}$$

$$600 - T_2 = 269.064$$

$$T_2 = 600 - 269.064$$

$$= \boxed{330.936^\circ C}$$

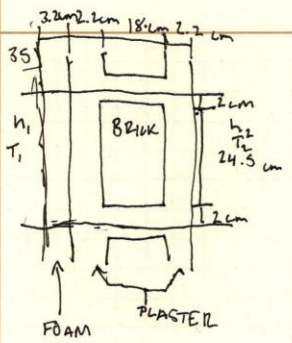
[23]



$$Q = \frac{T_3 - T_0}{\frac{L_1}{K_1 A} + \frac{L_2}{K_2 A} + \frac{L_3}{K_3 A}}$$

$$\frac{k_1 A (T_1 - T_0)}{L_1} = \frac{K_2 A (T_2 - T_1)}{L_2} = \frac{K_3 A (T_3 - T_2)}{L_3} =$$

$$\boxed{\frac{T_3 - T_0}{\frac{L_1}{K_1 A} + \frac{L_2}{K_2 A} + \frac{L_3}{K_3 A}}}$$



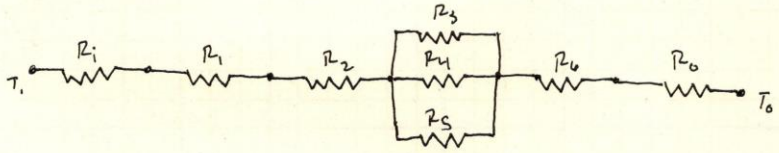
BRICK
H = 3.5 m
W = 6 m
K = 0.6 W/m.°C

PLASTER
L = 4cm
K = 0.22 W/(m.°C)
L = 2.2 cm

FOAM
L = 3.2 cm
K = 0.2 W/(m.°C)

$T_1 = 27°C$
$T_2 = 10°C$

$h_1 = 10\ W/(m^2.°C)$
$h_2 = 30\ W/(m^2.°C)$



$$R_i = \frac{1}{10 \times 0.33 \times 1}$$
$$= 0.303\ K/W$$

$$R_1 = \frac{(3.2cm \times \frac{1m}{100cm})}{0.026 \times 0.33 \times 1}$$
$$= 3.73\ K/W$$

$R_2 = R_6$

$$= \frac{(4cm \times \frac{1m}{100cm})}{0.22 \times 0.33 \times 1}$$
$$= 0.5509\ K/W$$

$R_3 = R_5$

$$= \frac{(18cm \times \frac{1m}{100cm})}{0.22 \times 0.015 \times 1}$$
$$= 54.54\ K/W$$

$$R_4 = \frac{(18cm \times \frac{1m}{100cm})}{0.12 \times 0.3 \times 1}$$
$$= 0.833\ K/W$$

R OF PARALLEL

$$\frac{1}{R_{PAR}} = \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}$$
$$= \frac{1}{54.54} + \frac{1}{0.833} + \frac{1}{54.54}$$

$$R_{par} = 0.8033\ K/W$$

$$R_0 = \frac{1}{30 \times 0.33 \times 1}$$
$$= 0.10101\ K/W$$

$$R_{TOT} = 0.303 + 3.73 + 0.5509 + 0.8033 + 0.2754 + 0.1010$$
$$= 5.7683\ K/W$$

$$\dot{Q} = \frac{T_1 - T_0}{R_{TOT}}$$
$$= \frac{27 - 10}{5.7683}$$
$$= 2.9471$$

$$\dot{q} = \frac{2.9471}{0.33}$$
$$= 8.93\ W/m^2$$

$$Q_{TOT} = 8.93 \times 4 \times 6$$
$$= \boxed{214.34\ W}$$