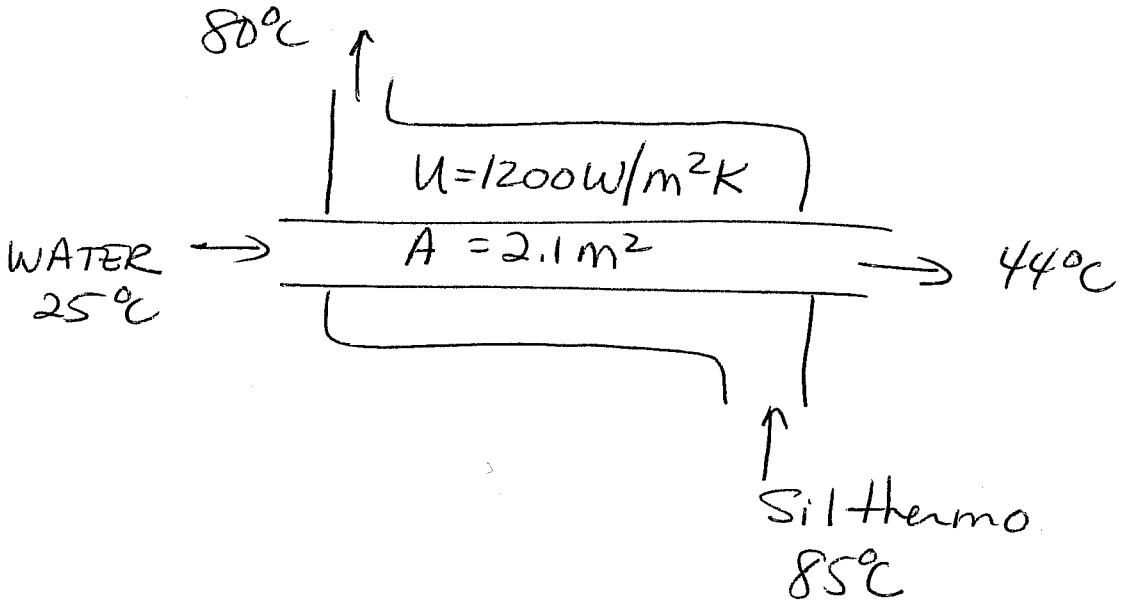
Mini Exam 3
CM3110
11 Nov 2008

1.



a. $$\Delta T_{lm} = \frac{\Delta T_1 - \Delta T_2}{\ln\left(\frac{\Delta T_1}{\Delta T_2}\right)}$$

$$\Delta T_1 = 80 - 25 = 55°C$$

$$\Delta T_2 = 85 - 44 = 41°C$$

$$\Delta T_{lm} = \frac{55-41}{\ln\left(\frac{55}{41}\right)} = \frac{14}{\ln(1.34146)}$$

$$= 47.65777 = \boxed{48°C}$$ (a)

6. $Q = UA\,\Delta T_{lm}$

$= \left(\frac{1200\,W}{m^2 K}\right)(2.1\,m^2)(47.65777\,K)$

$= 120{,}097.58\,W \left(\frac{kW}{10^3 W}\right)$

$= \boxed{120\,kW}$ (6)

2. Heat flux in an annulus:

$$\frac{q_r}{A} = \frac{C_1}{r}$$

at outer wall, $r = \frac{11}{2}\,cm = 5.5\,cm$

$= 0.055\,m$

$$\frac{q_r}{A} r = C_1 = \frac{q_r r}{\pi D L}$$

$$C_1 = \frac{(4200\,kW)(0.055\,m)}{(\pi)(0.11\,m)(1.2\,m)}$$

$$\boxed{q = 557.0423\,\frac{kW}{m}}$$

at inner wall:

$$r = 4\,cm = .04\,m$$

$$\frac{q_r}{A} = \frac{C_1}{r}$$

$$\frac{q_r}{A} = \left(\frac{557.0423\,kW}{m}\right)\left(\frac{1}{.04\,m}\right)$$

$$= 13926\,\frac{kW}{m^2}$$

$$= \boxed{14000\,kW/m^2}$$

2 SIG FIGS

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