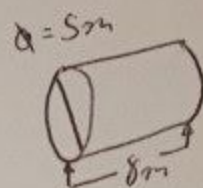


30/4/20 Time Started: 11:00
 Engineering Science (M4X02192)
 Ethan Johnson - 1902940
 Page 1 of 4

"cooling tower... hollow cylinder"

Nice!



Q1	5	9
Q2	11	11
Q3	6	11
Q4	16	17
	38	48

Q1.

$$T_1 = 68^\circ\text{C} + 273 = 341\text{K}$$

$$T_2 = 15^\circ\text{C} + 273 = 288\text{K}$$

$$A = \frac{\pi \times 5^2}{4} \times 8 = \frac{\pi \times 5^2}{4} \times 8$$

$$h/k = 1.7\text{W/mK}$$

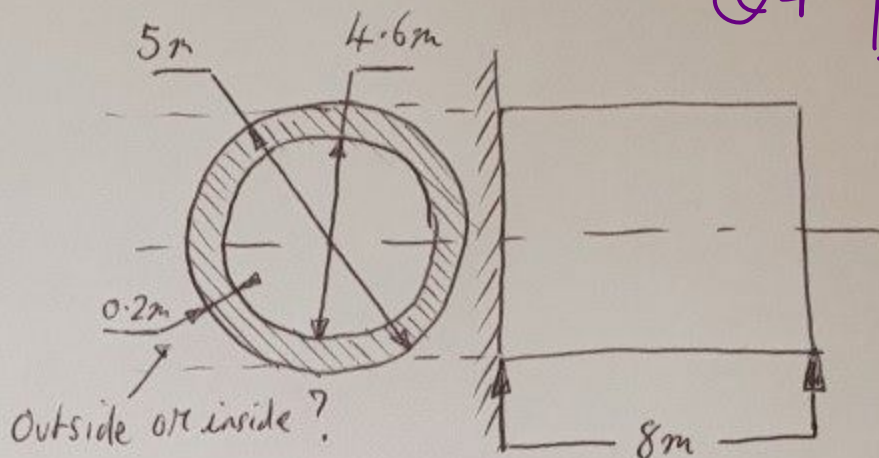
$$x = 0.2\text{m}$$

$$U = 12\text{W/m}^2\text{K}$$

1 = Surface Area of everything

② = Surface area of both sides outer side + thickness

3 = Volume



$$\frac{\pi \times (D^4 - d^4)}{4}$$

$$\left(\frac{\pi \times (D)^2}{4} - \frac{\pi \times (d)^2}{4} \right) \times 8$$

$$\left(\frac{\pi \times 5^2}{4} - \frac{\pi \times 4.6^2}{4} \right) \times 8$$

$$\pi d \times 8 = A = 125.66\text{m}^2$$

✓ ③

~~$$2 \times \frac{\pi \times d^2}{4} \times 8 = 164.936\text{m}^2$$~~

~~$$\left(\frac{\pi \times d^2}{4} \times 8 \right) + \left(\frac{\pi \times D^2}{4} \times 8 \right) = A$$~~

~~HOLLOW CYLINDER~~

h.

$$Q = \frac{-kA(T_2 - T_1)}{x}$$

$$Q = uA(T_2 - T_1)$$

$$\frac{-12 \times 125.66 \times (341 - 288)}{0.2}$$

$$= 19979\text{W}$$

$$\approx 19.98\text{kW}$$

~~$$= 179.91\text{kW}$$~~

Q =

then add the two.

Q 30/04/20 Time Started: 11:00

Engineering Science
(M4X02192)

Ethan Johnson-1902940

Page 2 of 4

Q2.

$$N/m^2 = Pa$$

$$d = 12mm = 12 \times 10^{-3} m$$

$$\sigma = 304 MPa = 304 \times 10^6 Pa$$

$$168kN$$

$$F = 165kN = 165,000 N$$

$A =$

$$\tau = \frac{F}{A}$$

$$\phi = 12 \times 10^{-3} m$$

$$A = 1.13 \times 10^{-4} m^2$$

$$A = \frac{F}{\tau}$$

$$\frac{A}{12 \times 10^{-3}} = ?$$

$$A = 542.76 \times 10^{-6} m^2$$

$$\frac{542.76 \times 10^{-6}}{1.13 \times 10^{-4}} = 4.80$$

$$= \underline{\underline{5 bolts}}$$

yay!

More workings!

Q30/04/20 Time Started: 11:00
 Engineering Science (M4X02192)
 Ethan Johnson - 1902940

Page 3 of 4

Q3.

$\theta = ?$

$\delta = 5$

$B = 786 \text{ Pa} \quad 78 \times 10^9 \text{ Pa} \quad \checkmark \textcircled{1}$

$l = 140 \text{ mm} = 0.14 \text{ m} \quad \checkmark \textcircled{1}$

$T = 10 \text{ Nm}$

$J = \frac{27.06 \text{ m}^4}{676.58 \text{ m}^4}$

$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{l}$

$\frac{T}{J} = \frac{G\theta}{l}$

$J = \frac{5\sqrt{3}}{8} \times \delta^4$

$J = \frac{5\sqrt{3}}{8} \times 5^4 = 27.06 \text{ m}^4 \quad 676.58 \text{ m}^4$

Really! 0.005m.

Shame!

$\frac{Tl}{JB} = \theta_{\text{rad}} \quad \textcircled{2}$

$\frac{10 \times 0.14}{27.06 \times (78 \times 10^9)} = 6.63 \times 10^{-13} \text{ rad}$

$\frac{10 \times 0.14}{676.58 \times (78 \times 10^9)} = 2.65 \times 10^{-14} \text{ rad} \quad \textcircled{1}$

$2.65 \times 10^{-14} \times \frac{180}{\pi} = 1.52 \times 10^{-12} \text{ deg}$

$\textcircled{1}$

Carried error.

30/04/20 Time Started : 12:00
 Engineering Science (M4x02192)
 Ethan Johnson - 1902940

Page 4 of 4

Q4.

$$M = 6200 \text{ Nm}$$

$$E = 210 \text{ GN/m}^2 = 210 \times 10^9 \text{ N/m}^2$$

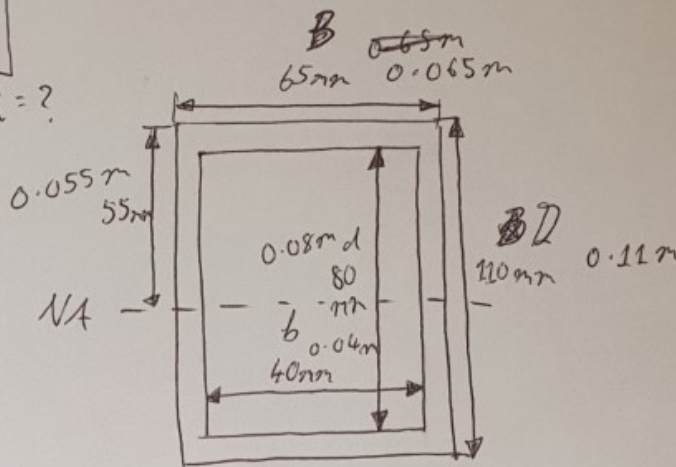
$$\sigma = ?$$

$$R = ?$$

$$I = 5.50 \times 10^{-6} \text{ m}^4$$

$$y = 0.055 \text{ m} \quad \checkmark$$

$$b = ? \quad R = ?$$



$$I = \frac{BD^3}{12} - \frac{bd^3}{12} = \frac{5.802 \times 10^{-6}}{12} - \frac{5.50 \times 10^{-6}}{12} \quad \checkmark$$

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R} \quad \checkmark$$

$$R = \frac{EI}{M} = \underline{\underline{186.30 \text{ m}}} \quad \checkmark$$

$$\sigma = \frac{Ey}{R} = \underline{\underline{61 \times 10^6 \text{ N/m}^2}}$$

$$\underline{\underline{61 \text{ MN/m}^2}}$$

$$\underline{\underline{61.00 \text{ MN/m}^2}}$$

$$\underline{\underline{62 \text{ MN/m}^2}}$$

Wierd!

Workings!!