

P1

Callum Evans 1702660 30-4-20
M4X02142

$$D = 5m$$

$$h = 8m$$

$$A = \pi \times (2.5^2 - 2.4^2) = 1.53$$

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

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

$$x = 2000 = 0.2$$

Surface area of cylinder
 $= \pi d h$

$$T_2 = 68 + 273 = 341K$$

$$T_1 = 15 + 273 = 288K$$

$$Q = h A (T_2 - T_1)$$

$$Q = 12 \times 1.53 (341 - 288) \text{ (1)}$$

$$Q = 973$$

Q1	3	9
Q2	8	11
Q3	9	11
Q4	14	17
	34	48

71%

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

$$Q = \frac{-1.7 \times 1.53 (341 - 288)}{0.2} \text{ (1)}$$

$$-689.27$$

$$Q = 973 + 689$$

$$Q = 283.73 \text{ X}$$

P1

Callum Evans 1702660

30-4-20

M4X02142

$$D = 5m$$

$$h = 8m$$

$$A = \pi \times (2.5^2 - 2.4^2) = 1.53$$

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

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

$$x = 2000 = 0.2$$

$$T_2 = 68 + 273 = 341K$$

$$T_1 = 15 + 273 = 288K$$

$$Q = h A (T_2 - T_1)$$

$$Q = 12 \times 1.53 (341 - 288)$$

$$Q = 973$$

Duplicate
Page.

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

$$Q = \frac{-1.7 \times 1.53 (341 - 288)}{0.2}$$

$$= -689.27$$

$$Q = 973 + 689$$

$$Q = 283.73$$

P2

Callum Evans 1702660 30-4-20
M4 x 02192

$$2) \quad \tau = 304 \text{ MPa} = 304 \times 10^6$$

$$F = 165 \text{ kN} = 165 \times 10^3$$

$$12 \text{ mm} = 0.012$$

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

$$\cancel{A} = \cancel{\frac{F}{\tau}} = \frac{165 \times 10^3}{304 \times 10^6}$$

$$\cancel{542.76 \times 10^{-6}}$$

✓ units?

(-0.5)

$$\cancel{0.00054276}$$

$$\cancel{5.4276 \times 10^{-4}}$$

Area of 1 bolt $\frac{\pi d^2}{4}$

$$= \frac{\pi \times 0.012^2}{4}$$

$$= 1.13 \times 10^{-4}$$

✓ units?

(-0.5)

Workings.

(-2)

$$= 5 \text{ bolts}$$

✓

P3

Callum Evans 1702660

30-4-20

M4X02142

3) $G = 78 \text{ GPa} \quad 78 \times 10^9 \text{ N/m}^2$

$S = 0.05 \text{ m}$

$L = 0.14 \text{ m}$

$J = \frac{S \sqrt{3}}{8} \times 10^{-4}$

$J = 6.77 \times 10^{-10}$

$T = 10 \text{ nm}$

$\frac{T}{J} \rightarrow \frac{G \theta}{L}$

$\frac{TL}{J} = G \theta$

$\left(\frac{10 \times 0.14}{6.77 \times 10^{-10}} \right)$
 78×10^9

$\theta = 0.03 \text{ rads to 2 dp}$

degrees?

P4

Callan Evans 1702660 30-4-20
m4x02192

4) $m = 6200 \text{ nm}$

$E = 210 \text{ GPa/m}^2$

$E = 210 \times 10^9 \text{ N/m}^2$ ✓ ①

$\gamma = 0.055$ ✓ ③

$BD = 0.065 \times 0.11$ ①

$BD = 7.15 \times 10^{-3} \text{ m}^2$

$bd = 0.040 \times 0.080$ ①

$bd = 3.2 \times 10^{-3} \text{ m}^2$

$\frac{BD^3}{12} - \frac{bd^3}{12}$

$I =$ ~~7.15×10^{-3}~~

$I = \frac{7.15 \times 10^{-3}}{12} - \frac{3.2 \times 10^{-3}}{12}$

Only the d is cubed.

$I = 2.77 \times 10^{-8} \text{ m}^4$

$\frac{m}{I} = \frac{E}{R}$

$R = \frac{I E}{m}$ ② $= \frac{2.77 \times 10^{-8} \times 210 \times 10^9}{6200}$ ①

$R =$ ~~105.76×10^3~~

$R = 438.22 \times 10^3 \text{ N}$ x Carried error

p5

Callum Evans 1702660 30-4-20
M4X02142

$$\frac{m}{I} = \frac{6}{y}$$

$$\frac{m y}{I} = 6 \quad (2)$$

$$\frac{6200 \times 0.055}{2.77 \times 10^{-8}} \quad (1)$$

$$6 = 1.23 \times 10^{10} \text{ Nm}^2 \times \text{Carried error.}$$