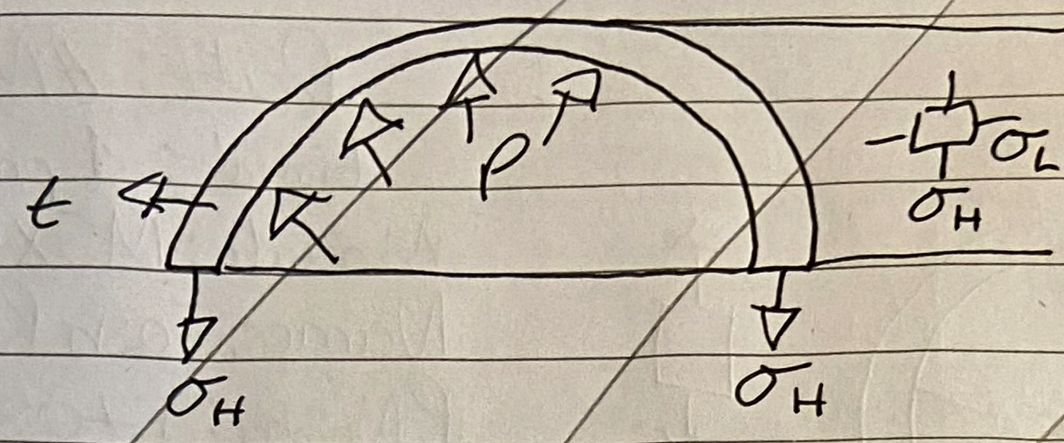
Q1)



Date: 7/May/20
Time: 1pm
Module: MSX02064
Name: Josh Rhyslewis
PNumber: 1703080

$$\sigma_n = \frac{Pd}{2t}$$

force on half cylinder ? = P x Poject Area
= P x dL

Resistance force? $2\sigma_H Lt$ ~~2~~ x 5 x H x 2

~~total Resistive force~~ =

$$2\sigma_H Lt = PdL$$

$$\therefore \sigma_H = \frac{Pd}{2t}$$

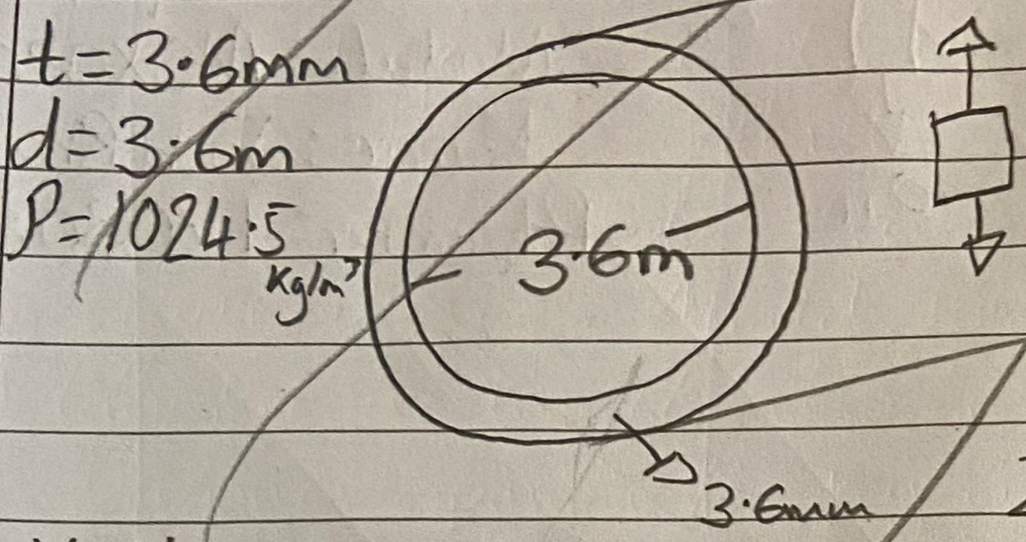
- b) hoop Stress is twice that of the longitudinal

c) $1.0245 g/cm^3$ convert to m^3/kg *

$$\frac{\times 1000}{100} = 1024.5 kg/m^3$$

②

Date: 7/May/20
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Yeild Stress = 195 MPa

Zero pressure inside the Submarine

$P = \rho g h$

$P = 0$

$g = 9.81$

$\rho = 1024.5$

P

How deep can the Sub go? h

$\frac{\sigma_H (2t)}{d}$ $P = \frac{195(2 \times 0.00036)}{3.6} = 39 Kpa$

No Safety factor

$\frac{P}{\rho g} = h$ $\frac{39 \times 10^3}{1024.5 \times 9.81} = 3.88m$

Safety factor of 2

Safety factor

$P = 78 kpa$ $h = 7.76m$

e)

3

Date: 7/May/2020
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moudle: M5x02064
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PNumber: 1703080

Q2)

1) Define the Problem -> So you should firstly consider the type of product / what the customer needs. Ensure you have a great understanding of what you need to achive, you should also look at what other Competitors are doing with the Specific problem/product. at this Stage you should consider Costs & coastomer Safdy. towards the end of this Section you would hope to see a rough prototype. You may have to come back to this Stage if you run into issues Remeber defining the problem isnt the Same As Regongising a need!o.

2) Gather Relevant info -> before diving into the design process it is nessacary to gather Some relevant information on the Problem/Product @hand, this could lead to Redefining the problem at hand. Things to consider? is the Statement accurate?, are there existing Solutions? is there a right way to Solve the problem Are any other companies working on the same issue?, is it worth the time and effort/can the customers afford the Solution, what are the main Safety factors. To elivate this we need to ensure we have an extensive Search on the problem, Make Sure to make full use of common Resorces Suchas online, indexes, Eelectronic catalougs, enclapedias. And most importa is the part SAFE.

Date: 7/May/2020
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3) Generate Multiple Solutions
At this Stage you should be considering the Synthisis of New ideas to solve the Problem. Dont be Afraid to take Risks @ this Stage! you should also make Sure to get everyones opinion to try and Achive the best Possible outcome, Maybe have a big brainstorm for everone to give their input.

4) Analyse ~~Process~~ and Select Solution
At this Stage we should be Analysing Functional Analysis, industrial design & ergonmics insuring the product does what it is Supposed to do And feels nice. Consider manufacturing Methods & Safety of the product. (testing) And before going further ensure it will conform with the Regulations & Standards Required of the project.

5) Test & implement Solution -D At this point we Should be testing and implementing under real life circumstances. You Should have breifly Done this in Step4 So this Should be nearly done. The last Steps are to ensure you Apply for Patents to protect the design & And complete all Relative legislation & Maybe independent testers.

5

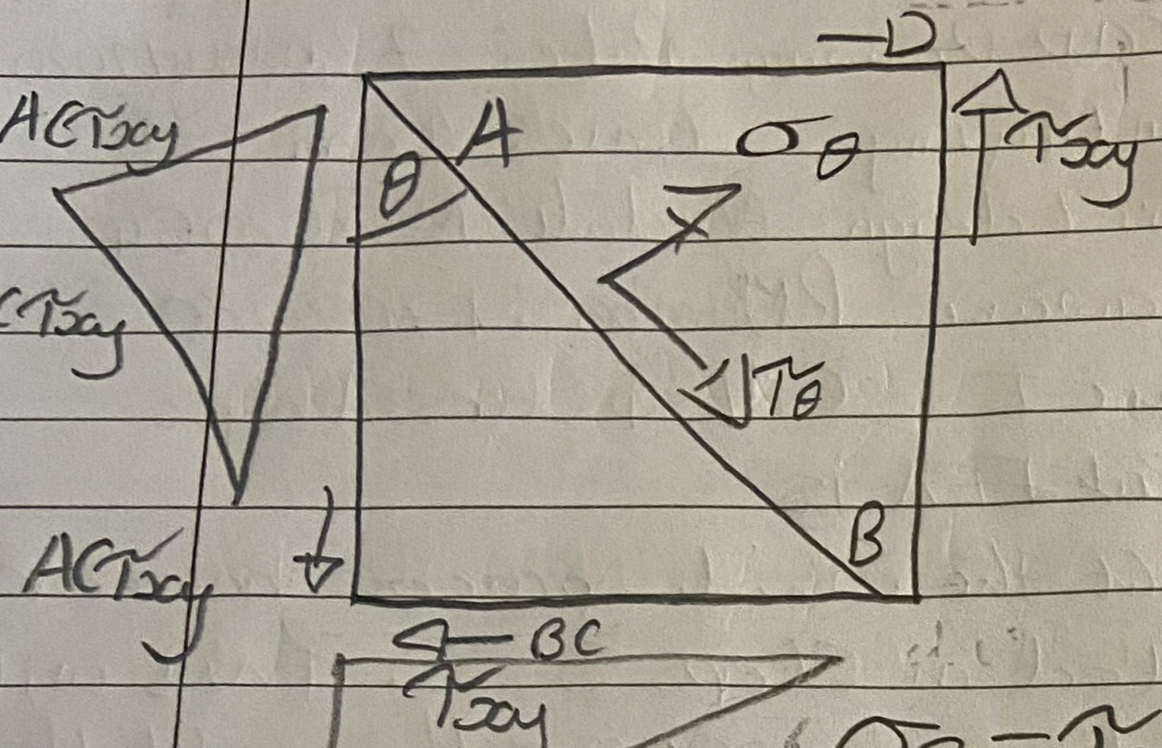
2b) Firstly you Should consider FEA from your first CAD Drawings as you can then identify any weaknesses in the first design to then make you aware of Any Signs of failure I would Say that ~~that~~ FEA is important throughout the whole process however It is mostly needed in Steps 3-5. This will overall cause less time in CAD ~~as~~ throughout the Process thus cutting the overall time & cost of the Design process

Name: Josh Rhys Lewis
Date: 7/May/2020
time: 1pm
Module: M5X02064
PNumber: 1703080
CAE $ Stress Analysis

Name: Josh Rhys Lewis
Time: 1pm
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Date: 7/May/2020
Pnumber: 1703080

Shear Stress only

4)



$\sigma_\theta = \tau_{xy} \sin 2\theta$

Equilibrium $\rightarrow \Sigma F$ $\perp$ to $AB = 0$

$AB\sigma_\theta = AC\tau_{xy}\sin\theta + BC\tau_{yx}\cos\theta$

$AB\sigma_\theta = AC\tau_{xy}\sin\theta$

$\div$ by AB $\sigma_\theta = \frac{AC}{AB}\tau_{xy}\sin\theta + \frac{BC}{AB}\tau_{xy}\cos\theta$

$\measuredangle$ 1 @ Diagram $AB\cos\theta = AC$ $AB\sin\theta\ BC$

$\therefore \cos\theta = \frac{AC}{AB}$ $\therefore \sin\theta = \frac{BC}{AB}$

$\sigma_\theta = \tau_{xy}\sin\theta\cos\theta + \tau_{xy}\sin\theta\cos\theta$

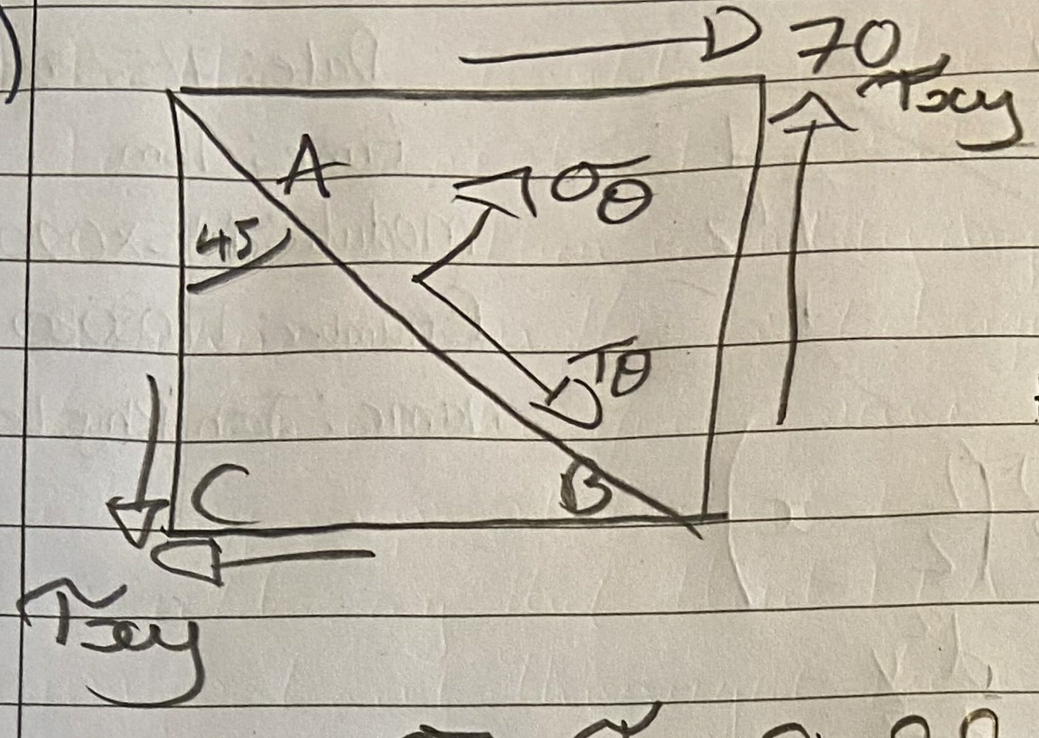
$= 2\tau_{xy}\sin\theta\cos\theta$

Now $\sin\theta\cos\theta = \frac{1}{2}\sin 2\theta$

$\therefore \tau_{xy}\sin 2\theta = \sigma_\theta$

7

b)



Date: MAY 7th 2020
time: 1pm
Module code: M5X02064
name: Josh Rhys Lewis
P-number: 1703080

$O\theta = T_{xy} \sin 2\theta$

$O\theta = 70 \sin(90)$

$= 70 MPa$

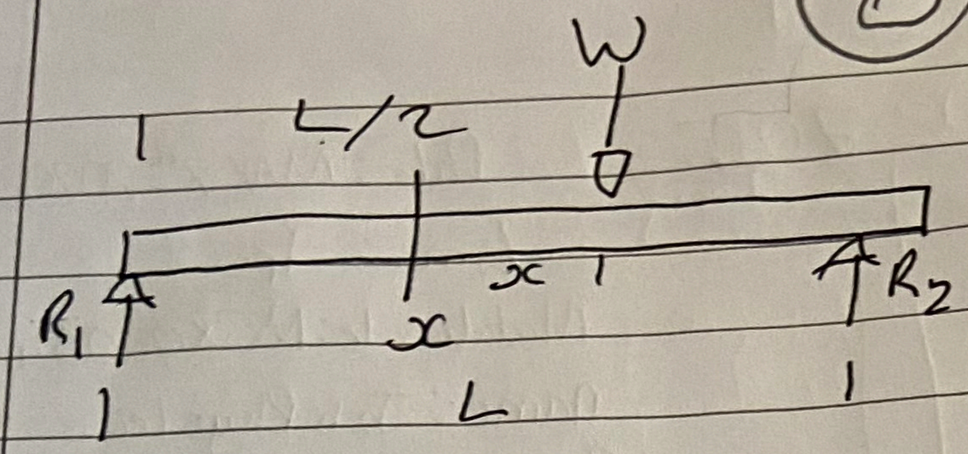
c) $T\theta = -T_{xy} \cos(2\theta)$

$-70 \cos(90) = 0$

d) An Example of Shear Stress could be cutting a carrot uses Shearing Stress to cut through. It could also be a set of Shears

e) The reason this is unlikely is due to there usually being another force involved for example a twisting moment whilst using the Shears. This is because you have rotation in your hands whilst using them. As for the carrot it could be more compressive than a shearing action.

Q3



(8)

Date: 7/5/2020
time: 1pm
module: M5X02064
Pnumber: 1703080
Name: Josh Rhys Lewis.

moment@XX $\frac{W}{2}\left(\frac{L}{2}-x\right)$

$$\frac{WL}{4}-\frac{Wx}{2}=EI\frac{d^2y}{dx^2}$$

$$EI\frac{dy}{dx}=\frac{WLx}{4}-\frac{Wx^2}{4}+A \quad \text{and} \quad EIy=\frac{WLx^2}{8}-\frac{Wx^3}{12}+Ax+B$$

$x=0 \quad A=0$ when x is L/2 deflection is zero

$$B=-\frac{WL^3}{48} \quad \therefore \quad y=\frac{1}{EI}\left[\frac{WLx^2}{8}-\frac{Wx^3}{12}-\frac{WL^3}{48}\right]$$

b) $$y_{max}=\frac{-WL^3}{48EI}$$ Since Max deflection when $x=0$

c) $W=48kN$
$E=215\times10^9$
$I=60\times10^{-6}$

$$y_{max}=\frac{-WL^3}{48EI}$$

$$\therefore L=\sqrt[3]{\frac{y_{max}\times48EI}{W}}$$

$$\therefore L=\sqrt[3]{\frac{0.01\times48(215\times10^9)(60\times10^{-6})}{48\times10^3}}$$

$$\sqrt[3]{129}$$

$L=34.07m$