

**Complete, fold and seal
(see note 2 below)**

SURNAME: Sorg

FORENAME(S): Jason

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	1700589
2	Title of Examination Paper	CAE and stress
3	Module Code	MSX 02064
4	Date and Time of Examination	may, 4/2019
5	Examination Venue	20310
6	Seat Number	6026
7	Number of Answer Books handed in	1

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

47.5%

- a) Principal stress - IS the stress ~~occurring~~ occurring along the centre of the object that is the maximum stress developed from the loading.
Principal plane - The angle in which the principal stress is occurring within the object due to the specific loading.

(2½)

$$b.i) \quad AB \sigma_{\theta} = BC \cos \theta T_{xy} + AC \overset{\sin}{\cos} \theta T_{xy}$$

$$\frac{AB \sigma_{\theta}}{AB} = \frac{BC}{AB} \cos(\theta) T_{xy} + \frac{AC}{AB} \cos \theta T_{xy}$$

~~Q.E.D.~~

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

$$\sigma_{\theta} = \frac{1}{2} \sin 2\theta T_{xy} + \frac{1}{2} \sin 2\theta T_{xy}$$

$$\sigma_{\theta} = \sin 2\theta T_{xy}, \quad \underline{\sigma_{\theta} = T_{xy} \sin 2\theta}$$

(4)

$$b.ii) \quad \cancel{AB T_{\theta} = T_{xy} \sin \theta \cos \theta - T_{xy} \cos \theta \sin \theta}$$

$$\frac{AB T_{\theta}}{AB} = T_{xy} \sin \theta \cos \theta - T_{xy} \cos \theta \sin \theta$$

$$T_{\theta} = T_{xy} \sin \theta \cos \theta - T_{xy} \cos \theta \sin \theta$$

$$T_{\theta} = T_{xy} \sin^2 \theta - T_{xy} \cos^2 \theta$$

$$\underline{T_{\theta} = -T_{xy} \cos 2\theta}$$

(5)

2

$$L) A = 0.8 \text{ m}^2$$

$$F = 45000 \text{ N}$$

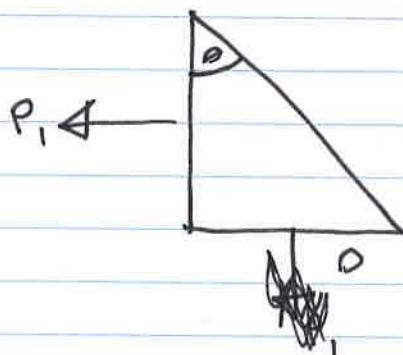
$$\theta = 90^\circ - 20^\circ$$

$$\theta = 70^\circ$$

$$p = \frac{45000 \text{ N}}{0.8 \text{ m}^2}$$

$$p = 56250 \frac{\text{N}}{\text{m}^2}$$

UNITS



~~$$\sigma_\theta = \frac{1}{2} \left(56250 \frac{\text{N}}{\text{m}^2} + 56250 \frac{\text{N}}{\text{m}^2} \right) + \frac{1}{2} \left(56250 \frac{\text{N}}{\text{m}^2} - 56250 \frac{\text{N}}{\text{m}^2} \right) \cos 2\theta (70)$$~~

~~$$\sigma_\theta = 1$$~~

$$\sigma_\theta = \frac{1}{2} \left(56250 \frac{\text{N}}{\text{m}^2} + 0 \right) + \frac{1}{2} \left(56250 \frac{\text{N}}{\text{m}^2} - 0 \right) \cos(140)$$

$$\sigma_\theta = 28125.0 \frac{\text{N}}{\text{m}^2} - 21544.98 \frac{\text{N}}{\text{m}^2}$$

$$\sigma_\theta = 6580.01 \frac{\text{N}}{\text{m}^2}$$

X

$$\tau_\theta = \frac{1}{2} \left(56250 \frac{\text{N}}{\text{m}^2} - 0 \right) \sin(140)$$

$$\tau_\theta = 18078.40 \frac{\text{N}}{\text{m}^2}$$

UNITS

(5)

a) Design problem is usually a general problem for example, (how the design is to be used by the end user, how to package the design correctly so that it will fit in certain components.

whereas an analysis problem is typically dealing with numbers and facts. For example, (A design has passed all the design element problems but now does not meet the stress requirements that are being acted upon it.) meaning a solution must be developed to solve this specific problem.

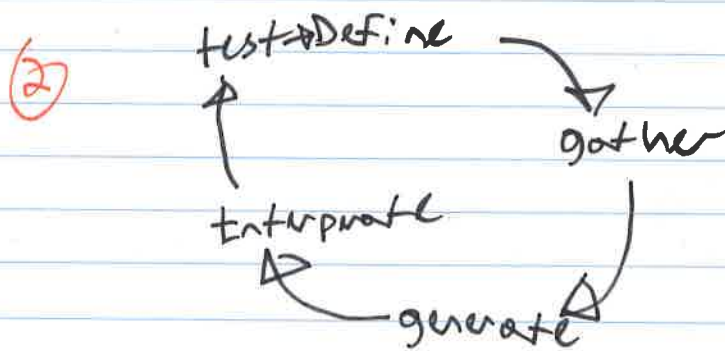
b) A design problem is iterative because there can be many concepts and ideas that generate the same end goal. Which is typically why over time the design changes due to solutions that will enhance and add strength to the design. meaning multiple ideas are the best way to come up with the best design.

whereas analysis problems are dealing with specific problems, meaning that in order to continue with the design process the problems must be dealt with in order. For example, the design must pass the stress requirements that it will see under loading before you can worry about how to optimize the part, or before you can start developing manufacturing methods.

C) ① Split
Interpret
materials
Physical property
Loading
Evaluate

advantages

X



①

③

2)

$$1.03 \frac{\text{kg}}{\text{cm}^2} \times \frac{1000000}{1000000}$$

$$\frac{M \cdot s^2}{M \cdot m}$$

b) $\sigma_H = 200 \text{ mpa}$
 $d = 3.5 \text{ m}$
 $p = 101 \text{ kpa}$

$$t = 5 \times 10^{-4} \text{ m}$$

$$\sigma_H = \frac{\rho g h d}{2 t}$$

$$\sigma_H \times 2t = \rho g h d$$

$$h = \frac{\sigma_H \times 2t}{\rho g d}$$

$$h = \frac{(200 \times 10^6 \text{ pa}) \times 2 (5 \times 10^{-4} \text{ m})}{9.81 \frac{\text{m}}{\text{s}^2} \times 3.5 \text{ m} \times 1.03}$$

$$h = \frac{200000}{35.365}$$

$$h = 5655.30 \text{ m}$$

$$h = 5655.30 \text{ m}$$

$$h = 5655.30 \text{ m}$$



Rounded to a safe
 height of 15000 feet

$$b.ii) h = \frac{200 \times 10^6 \text{ Pa} \times 2 \times 5 \times 10^{-4}}{0.768 \times 9.81 \frac{\text{m}}{\text{s}^2} \times 3.5 \text{ m}}$$

$$h = \frac{200000}{26.368}$$

$$h = 7584.58 \text{ m}$$

↓
rounded to a safe height of 20000 Feet

c) By pressurizing the plane's cabin the pressure difference across the shell is decreased, meaning the pressure from the outside can be greater, meaning the plane can experience higher altitudes, which is why part ii has a higher maximum altitude.
d)

BUT WHY?

e) Fluids stored in a spherical tank can withstand greater pressures because the denominator is divided by double, meaning the hoop stress is half of what a cylindrical container ~~can~~ produces ~~withstand~~. The reason why you would use →

1

A cylindrical container instead of a sphere, even though it will withstand only half the pressure is that cylindrical container's are much easier to store and handle.

①

Question No.

Examiner's

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Question No.

Examiner Only

Question No.

Examiner C

Question No.

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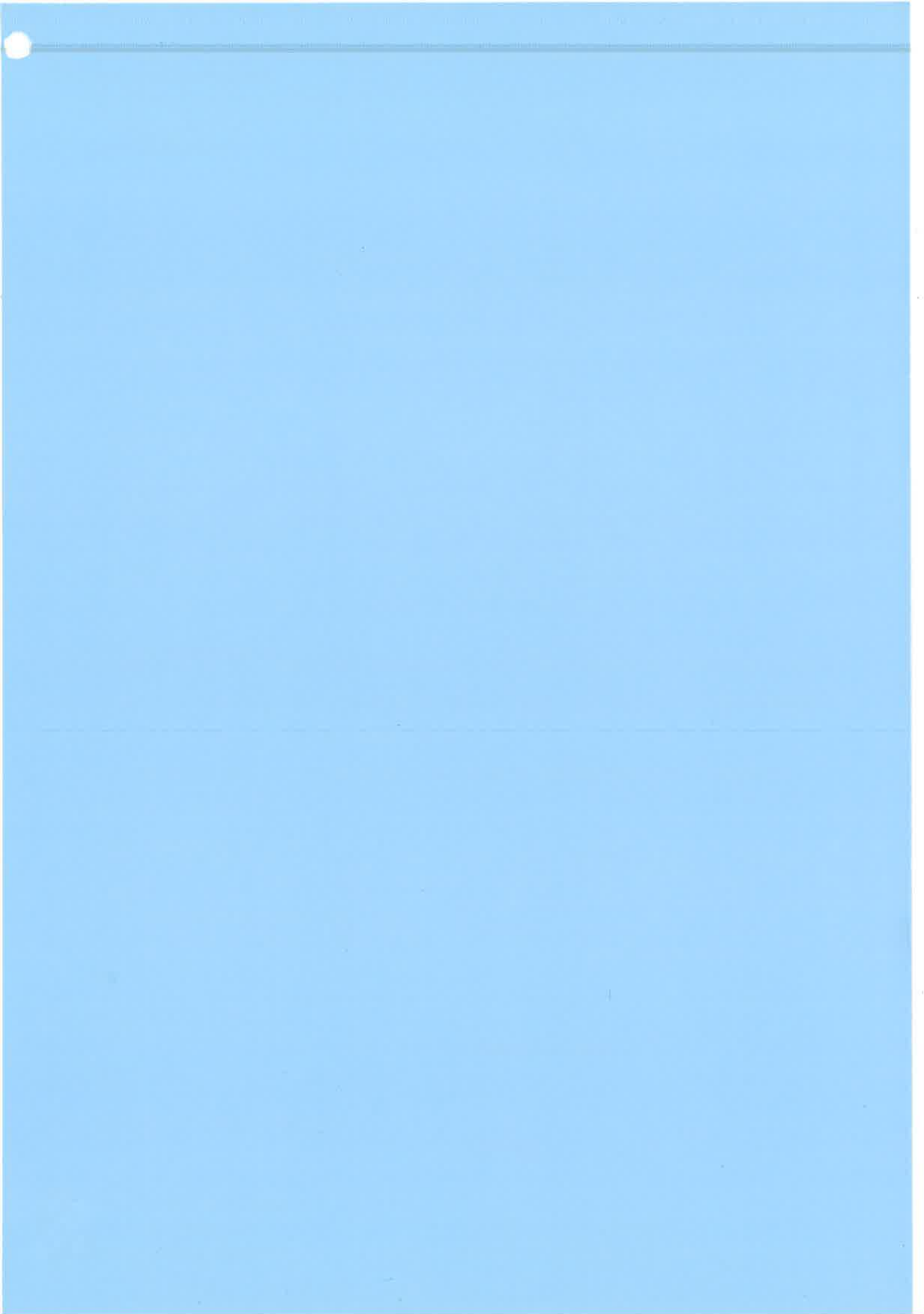
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(See the other side for English version)

ENW(AU) CYN TAF:

ENW(AU) CYNTAF: