



Complete, fold and seal
(see note 2 below)

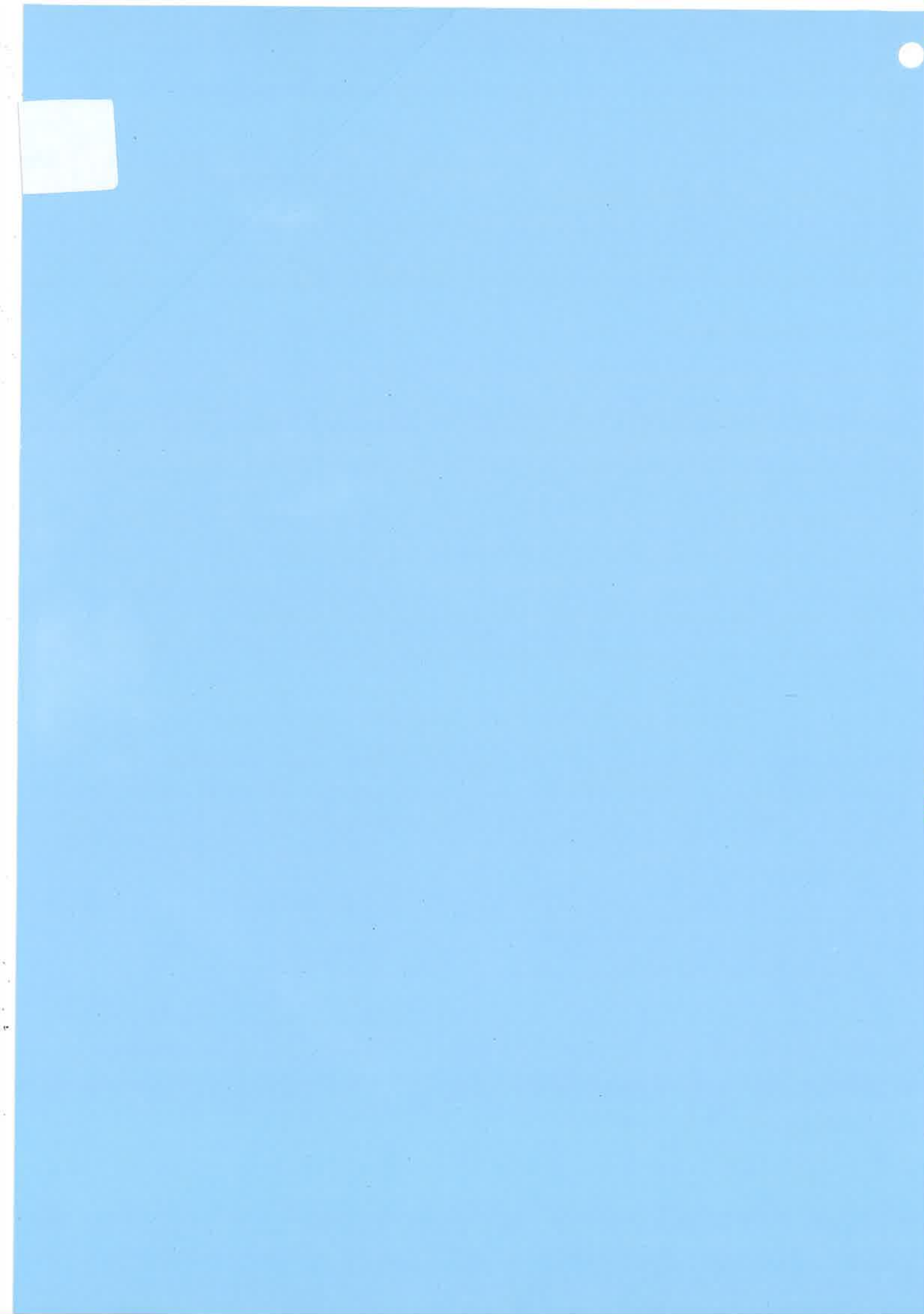
Blackmire

Joseph

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.**

List the numbers of the questions you have attempted	Office Use
1	10
2	4
3	8
Total	22

36.7%



OL stops ends blowing out

Examiner Only

1. $\sigma_H = \frac{Pd}{2t}$

$$P = \frac{\pi d^2}{4}$$

~~$P = \frac{F}{A}$~~

$$F = PA$$

$$A = 2 \times \pi \times d \times L \times 2$$

$$F = PdL$$

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

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

$$\sigma_H = \frac{\pi PdL}{2 \times \pi d \times L \times 2}$$

✓ (4)

6) $\sigma_H = 200 \times 10^6 \text{ Pa Max}$

$$d = 3.5 \text{ m} \quad t = 0.5 \times 10^{-3} \text{ m}$$

$$P = \rho gh \quad \text{max altitude}$$

(i) $\sigma_H = \frac{Pd}{2t} \quad \frac{(\rho gh \times 3.5)}{2 \times 0.5 \times 10^{-3}} = 200 \text{ MPa}$

$$g = 9.81$$

$$\rho gh = \frac{200 \text{ MPa} \times 2 \times 0.5 \times 10^{-3}}{3.5}$$

$$\rho gh = 0.057 \text{ MPa}$$

$$\rho gh = 57.143 \text{ kPa}$$

$$\text{Maximum altitude} = 14500 \text{ feet}$$

✗ (1)

(iii) pressurized to eq pressure 8000 ft

$$25.3 \text{ kPa pressurized}$$

$$57.143 - 25.3$$

$$= 31.843 \text{ kPa}$$

$$= 44500 \text{ ft}$$

(7)

Rhif y Cwestiwn

7. Pressurizing plane cabins allows the plane structure to withstand the stresses of flying at a higher altitude as the pressure difference between the interior and exterior of the plane is reduced. BUT WHY?

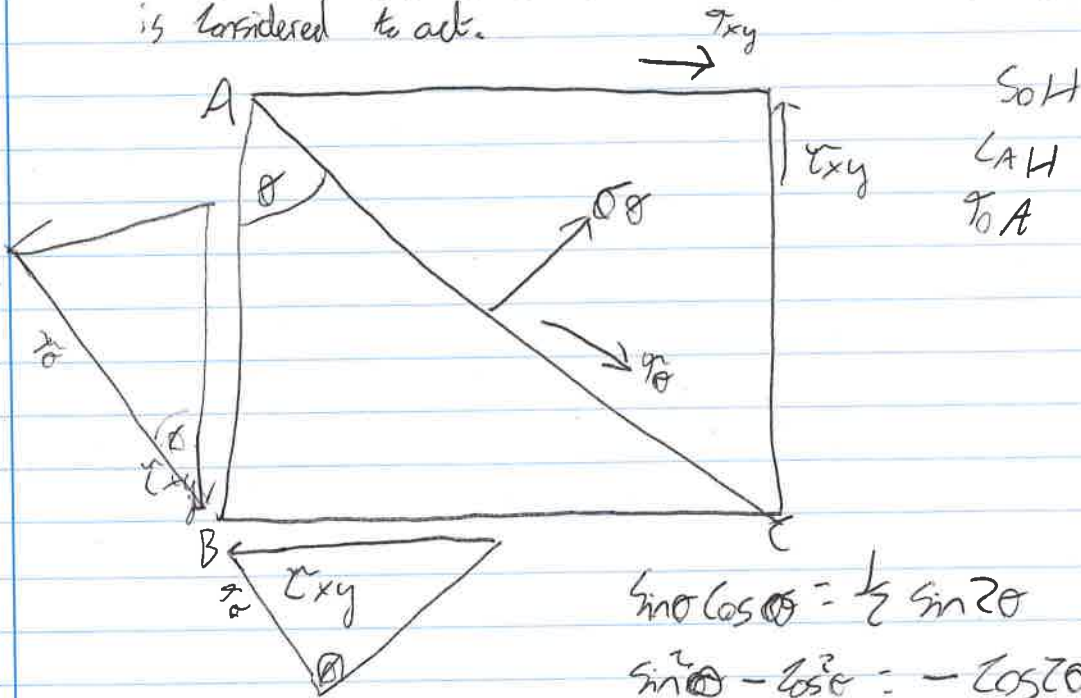
d. $\sigma_H = \frac{Pd}{4t}$

8. Storing fluids in spherical tanks allows the pressure of ~~the~~ tank to withstand higher hoop stresses. ~~A fluid of~~ oil can be stored more safely at higher pressure in a spherical tank compared to a cylindrical tank. Spherical containers however are more expensive to manufacture compared to cylindrical containers.

2. a. Principal stress is the ^{resultant} stress ~~that~~ acts according to the total stresses acting on the object

Principal Plane is the plane on which the principal stress acts, the direction on which the principal stress is considered to act.

(2)



(i)

$$\tan 2\theta = \frac{\tau_{xy}}{\sigma_x - \sigma_y}$$

X

2.)

$$I_{G, \text{Area}} = 800 \text{ mm}^2 = 800 \times 10^{-6} \text{ m}^2$$

$$F = 45 \text{ kN}$$

$$\theta = 20^\circ$$

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

$$\tau_{xy} = \frac{45 \times 10^3 \text{ N}}{800 \times 10^{-6} \text{ m}^2} \quad \tau_{xy} = 112.5 \text{ MN/m}^2$$

$$\sigma_\theta = 112.5 \text{ MN/m}^2 \times \sin 2(20)$$

$$\sigma_\theta = 77313606 \text{ N}$$

$$= 773.136 \text{ MN/m}^2$$

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

$$\tau = -861.8 \text{ MN/m}^2$$

X

(2)

Q3. A Design problem is usually an iterative process, as a problem is defined and multiple possible solutions are generated. The most useful solutions are then analysed and can be taken further through the design and analysis process. When working through a

(a) A design problem is often given a design brief that is more open to new ideas and innovation. A design problem is more vague in nature allowing for a more varied array of possible solutions. An analysis problem will have a more strict success criteria and specific aim i.e. the component needs to be made 1kg lighter without sacrificing torsional rigidity.

b) A design problem is usually an iterative process as multiple solutions are generated and analysed by the design team. The most promising solutions are carried forward through the design process and analysed in key areas such as manufacturability and ergonomics. In a design problem a solution may reach a stage in the design process and be deemed unfeasible, be it for economic ~~viability~~ viability, safety or ~~as~~ another key feature. This can lead to a solution being scrapped, starting the process again. Throughout the design problem the solution may be ~~continuously~~ improved and settled with iteratively throughout the process. An analysis problem is primarily sequential as the specific target for the process needs to be met in a step by step basis.

7.

X

Question No.

Examiner's

Arholwr yn unig

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Question No.

Examiner Only

Question No.

Examiner O

Arholwr yn unig

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Question No.

Examiner's

Arholwr yn unig

Arholwr yn unig



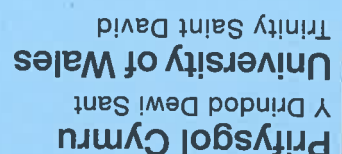
Question No.

Examiner O

Arholwr yn unig

llyf y Cwestiwn





12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i sello i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgript annarllenadwy, neu drefnu iddi! gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddyn.

6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwylwyr/gwylwyr.

8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Archoliad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyriwr	

[illegible]

(See the other side for English version)

Llenwch, plygwrch a seilwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF: