



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

FORENAME(S): OLIVER

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.**

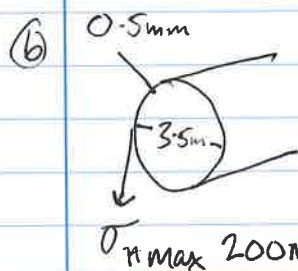
1	Student Number	P151457
2	Title of Examination Paper	CAE + STRESS
3	Module Code	M5X02064
4	Date and Time of Examination	9/5/2019
5	Examination Venue	1Q304
6	Seat Number	
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	9
2	9
3	2
Total	20

(Gweler yr ochr arall am y fersiwn Cymraeg)

33.3%



1.
a)

$$200 \times 10^6 \text{ N/m}^2 = \frac{P \cdot d}{2t} = \frac{P \times 3.5}{0.001} \Rightarrow \frac{200 \times 10^6 \times 0.001}{3.5} = P = 57143 \text{ N/m}^2$$

$$\Delta_{\max} 57.14 \text{ kPa}$$

i) Internal Pressure = 101 kPa
ext. Pressure = 101 kPa - 57 kPa = 44 kPa

20k 46.6

25k 37.6

5kPa - 9kPa

500ft = 1 - 0.9 kPa

20500 = 45.7

21k 44.8

21.5k 43.9

2A

i) 21,500 ft

ii)

int. P = 75.3 kPa

ext. P = 75.3 - 57.14 = 18.16 kPa

40k = 18.7

45k = 17.32

1k = 0.84 kPa

18.7 - 0.42

18.28

4

40,500 ft

⑦ De-Pressurising plane cabins reduces the difference between internal and external pressure, thus reducing ~~stress on the~~ hoop and longitudinal stresses on the walls of the plane. The result is that the plane can fly at a higher altitude where there is less wind resistance (due to lower density of air), so less fuel is needed and higher speeds can be reached.

②

- ② Spherical containers ~~resist~~ can resist ^{a higher} ~~pressure~~ pressure difference (between inside + out) than a cylinder. The reason is that with a cylinder, the (higher) hoop stress only acts in one direction, ~~whereas~~ perpendicular to the longitudinal stress (half the hoop stress). Whereas with a sphere or dome, the hoop stress acts in two directions.

BUT WHY?

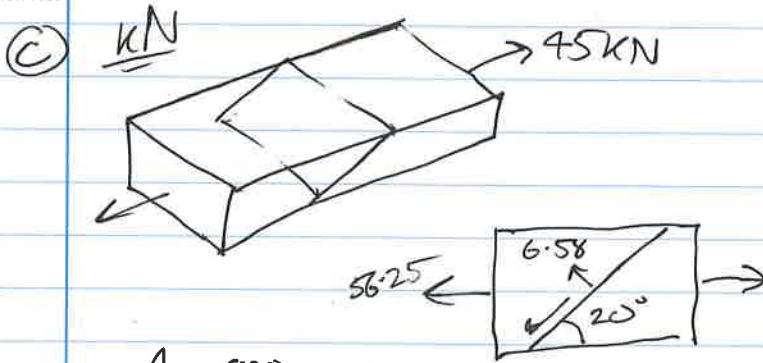
2. (a) Principal stress is the maximum and minimum stresses, σ_1 and σ_2 , they are at 90° from each other in an object.

Principal planes ^{are} the planes on which the principle stresses ~~act~~ act on.

(b)

3

X
0



$$A = 800 \text{ mm}^2$$

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

$$\sigma_x = \frac{F}{A} = \frac{45000}{800} = 56.25 \text{ N/mm}^2$$

$$\sigma_y = 0$$

$$\theta = 70^\circ$$

$$\sigma_\theta = 0.5(\sigma_x + \sigma_y) + 0.5(\sigma_x - \sigma_y)\cos 2\theta$$

$$0.5(56.25) + 0.5(56.25)\cos 140^\circ$$

$$28.125 + 28.125$$

$$\sigma_\theta = 56.25 \text{ kN/mm}^2 \text{ Normal stress on plane}$$

$$\tau_\theta = 0.5(\sigma_x - \sigma_y)\sin 2\theta$$

$$0.5(56.25)\sin 140^\circ$$

$$18.08 \text{ kN/mm}^2 \text{ Shear stress on plane}$$

(6)

3.

Ⓐ Differences between Design and Analysis:

A design problem starts with the solution (eg a machine), and then adapts and modifies it to the task (using iterative steps).
 An analysis problem would initially look at the requirements of the task, and then identify the necessary influences ~~necessary~~ to accomplish the task in the most effective way.

Ⓑ The design problem's main focus is the creation of an item ~~the~~, not ~~the~~ the creation of a perfect item. The item can evolve through iterations of changes to the design. ~~This enables manufacturers to~~

As improvements are staggered through time, the manufacturers are able to gradually improve the product at a pace that suits their marketing + sales strategy.

The Analysis Problem focuses on understanding as much as possible about the requirements, and addressing the needs in as efficient way as possible. If the analysis ~~is~~ is performed well, the need for iterative improvements are greatly reduced. Testing and verification are always ~~are~~ required but with a better understanding of the principles, they ~~are~~ significantly reduced.

Ⓒ

Ⓓ

Question No.

Examiner Onl

Arholwr yn unig

hif y Cwestiwn

Question No.

Examiner Only

Arholwr yn unig

Ynif y Cwestiwn

Question No.

Examiner Only

Question No.

Examiner Only

Arholwr yn unig

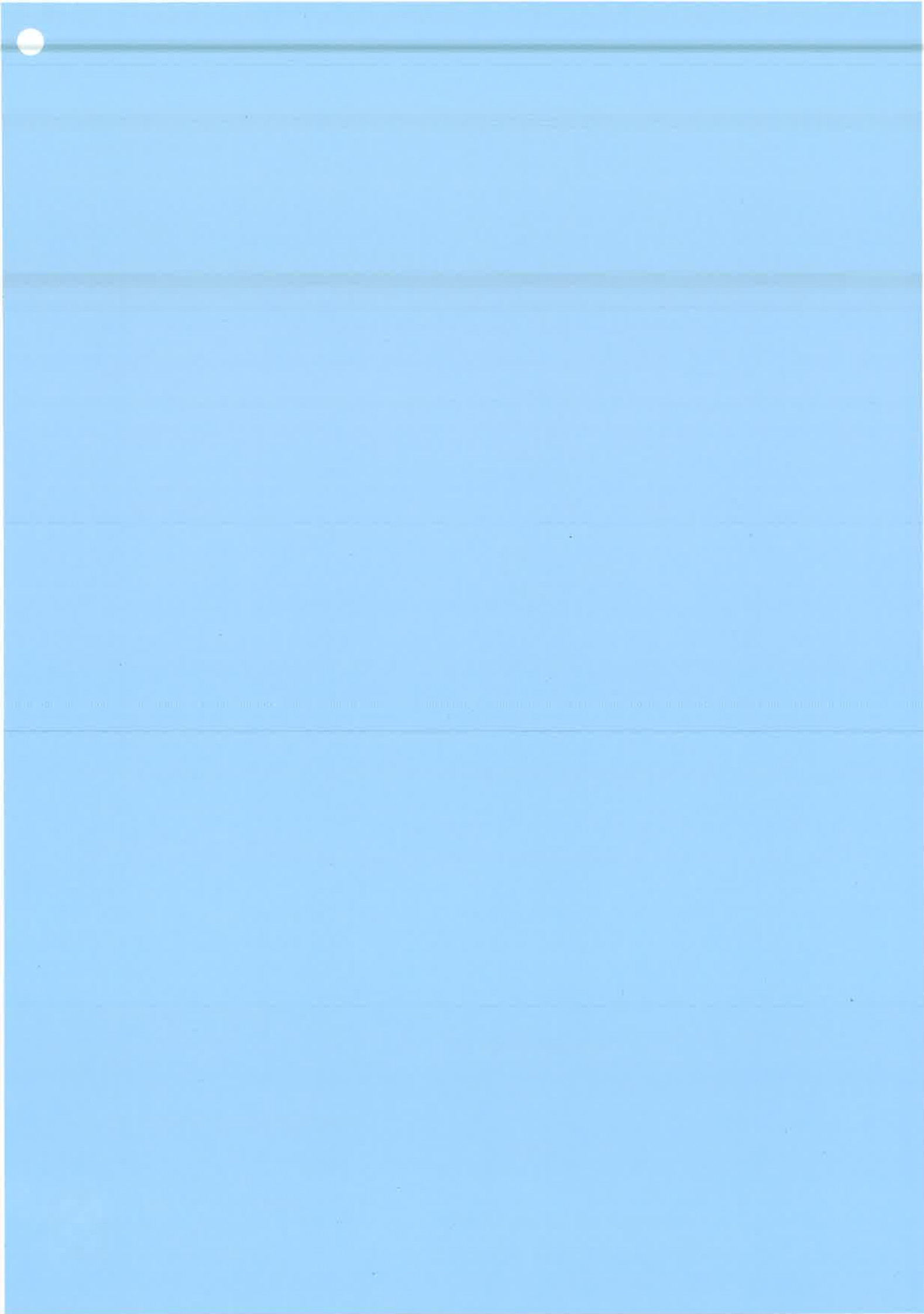
Thif y Cwestiwn

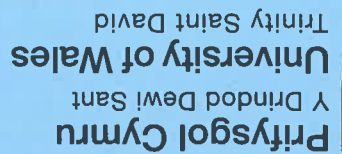
Question No.

Examiner Only

Arholwr yn unig

Unig y Cwestiwn





12 Tüdalen

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

3. Rhaid i'r atebion fod mewn llawysgriften ddarlunadwy. Gall yr Arholwyr nall ai anwybyddu sgrïpt annarllunadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgriptennwch eich atebion mewn inc.

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.

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 gwyllywr/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 seliwrch
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: