



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

SURNAME: Carter

FORENAME(S): Ewan

12 Pages

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
1a-e	18
3a-b	5
4a-c	0
Total	24

40%



1a)

$$2\sigma_H / t = \frac{\rho d^2}{t}$$

$$\therefore \sigma_H = \frac{\rho d}{2t}$$

b) $d = 3.5 \text{ m}$

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

$\sigma_{H \text{ max}} = 200 \times 10^6 \text{ Pa}$

$P = P_{gh} = 101 \times 10^3 \text{ Pa} - 46.6 \times 10^3 = 54.4 \text{ kPa}$

i at sea level:

~~$$\sigma_{H \text{ actual}} = \frac{(101 \times 10^3)(3.5)}{(2)(0.5 \times 10^{-3})}$$~~

$$200 \times 10^6 = \frac{P \times 3.5}{2 \times (0.5 \times 10^{-3})}$$

$$\frac{1}{P} = \frac{3.5}{2 \times (200 \times 10^6)(0.5 \times 10^{-3})}$$

$$P = \frac{2 \times (200 \times 10^6)(0.5 \times 10^{-3})}{3.5}$$

$$= 57.14 \text{ kPa}$$

$$101 - 57.14 \text{ kPa} = 43.86 \text{ kPa}$$

 $\therefore$ from table, max altitude = 20,000 ft.

$$\therefore \text{ @ 8,000 feet: } 75.3 - 57.14 = 18.16 \text{ kPa}$$

 $\therefore$ max altitude = 40,000 feet.

- c) By pressurising the Plane fuselage, the stresses from flying higher are reduced, thus allowing the Plane to fly higher, where the air is less dense, reducing drag and increasing fuel economy.

d) $4 \sigma_H \pi r t = \frac{P \pi d^2}{4}$

$$\sigma_H = \frac{P d}{4 t}$$

- e) From the equations derived, it can be noted that the hoop stress in a spherical tank is half that of a cylindrical one, meaning that the spherical tank can store fluids at twice the pressure of a cylindrical one.

BUT WHY?

2) a) A design problem is generally more vague in its brief whereas an analysis problem is more focused in the brief given

(2)

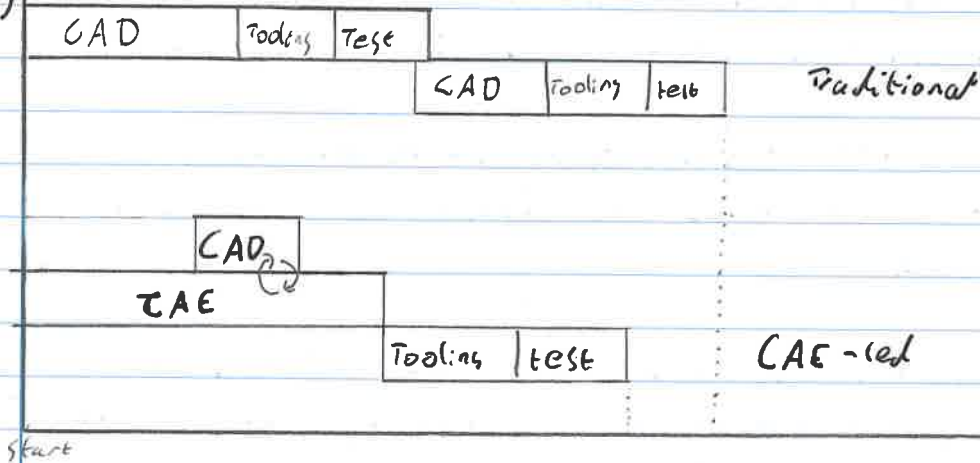
b) A design process problem is largely an iterative process because it means that changes can be made to the design as the process continues.

An analysis problem is largely sequential because the problem has to be analysed before any changes can be made, thus slowing the process down.

~~(1)~~

(4)

4a)



The major limitation of gradient based optimisation is that it has to go through each iterative step, meaning it takes much longer to produce the final product due to the time it takes to make each piece of tooling.

b) This major limitation can be overcome by using a CAE led engineering process, which feeds back into the CAD process using a feedback loop which means that less time can be spent producing tooling, thus meaning the product can be produced quicker.

c) The first type of optimisation in FEA is to simplify the model being studied by removing any parts that have little to no effect on the structural behaviour of the part when under load. This comes at the cost of losing accuracy within the simulation being carried out.

Another way of optimising FEA is to make the elements larger, ~~increasing~~ lowering the time required to perform the calculations necessary. This ~~can~~ also comes at the cost of accuracy of the simulation, but the increased throughput may make up for that.

Question No.

Examiner Or

Arholwr yn unig

ff y Cwestiwn

Question No.

Examiner Only

Question No.

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Question No.

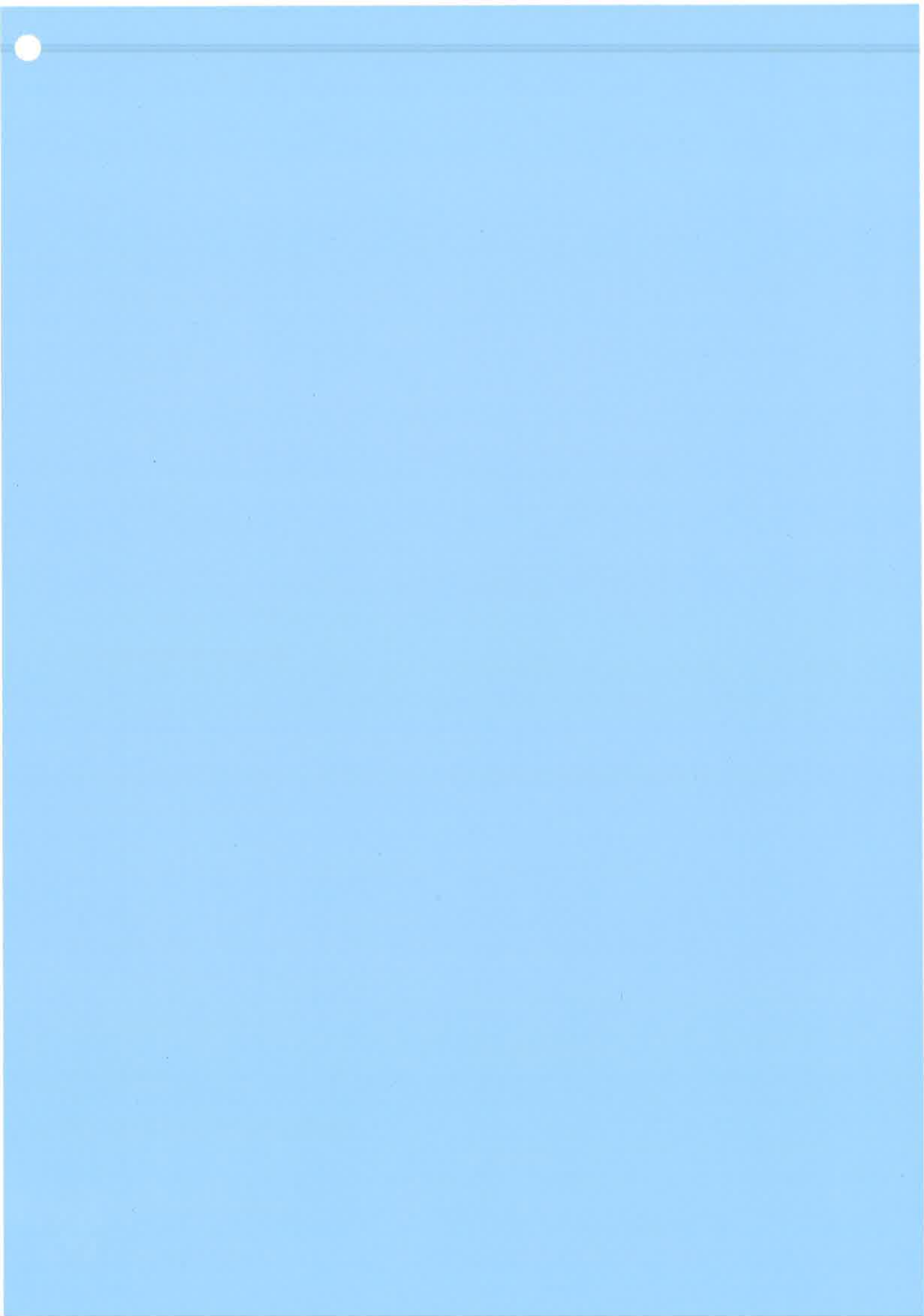
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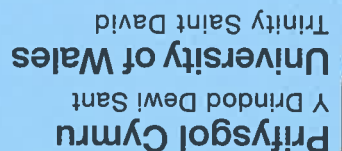
Question No.

Examiner On

Arholwr yn unig

llyf y Cwestiwn





12 Tudalen

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

3. Rhaid i'r atebion fod mewn llawysgriften ddarlennadwy. Gall yr Arholwyr naili ai anwybyddu sgrïpt annarllennadwy, neu drefnu iddi gael ei i'wheipio a chael yr ymgeisydd i dalu.

4. Vsgriitennwch 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 deinyddir 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 Arholiad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyriwr	

[illegible]

(See the other side for English version)

Llenwch, plynwch a selwch (gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

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