

Examiners' report

A LEVEL

DESIGN AND TECHNOLOGY: PRODUCT DESIGN

**OCR Level 3 Advanced GCE in Design and
Technology: Product Design**

H406

For first teaching in 2017

H406/02 Summer 2025 series

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate responses is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from [Teach Cambridge](#).

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Paper 2 series overview

Series overview

We were, again very pleased with the responses that we received from the cohort for H406/02, Problem Solving in Product Design. The candidates appeared to have had a good grounding across most of this exam and found the question paper to be accessible.

The report below seeks to give pragmatic advice to centres that will be helpful as they prepare their next cohort for this style of examination.

Basic concept

This style of examination has an allowed time of 1 hour 45 minutes.

The examination has a Resource Booklet that is inherently linked to the detail of the question paper and questions in it.

The recommended reading time for the Resource Booklet is 35 minutes, although it does seem that candidates have spent less time reading the booklet, as an initial task, to allow more time working on the actual question paper. Candidates appear to work through the Resource Booklet in unison with the question paper, as they work through both documents chronologically, this strategy is sensible and time efficient.

The total mark for this question paper is 70. The marks for each question are shown in brackets [].

Quality of extended responses is assessed in the questions marked with an asterisk (*).

Candidates often used subheadings to communicate effectively on extended responses as well as manufacture/assembly style questions, this is a very helpful tactic and appears to help candidates to order and thus communicate their thoughts more logically and clearly.

Candidates also used subheadings when questions include scaffolding that asked for responses to include specific bullet points, this was an extremely useful strategy for them to use.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• had a clear plan for extended response questions • used the scaffolding bullet points within questions to frame their responses • used subheadings to good effect to aid communication • had a full grasp of the specification and were able to apply their knowledge within an unfamiliar situation • used the Resource Booklet to exemplify their responses.	• did not plan extended response questions • did not always use the scaffolding bullet points fully to support their responses • responses consider one aspect of a question only • less successful in communicating their responses where sketching would have been helpful • did not read the question carefully and missed key aspects or words which meant they were unable to access the full marks.

Question 1

- 1 Discovery Play Museum (DPM) has identified an opportunity to increase profits. It wants to add equipment to its museum site that provides interactive play activities.

A study is required to ensure the commercial viability of interactive play activities. An important aspect to consider is the marketing strategy.

Critically examine the marketing methods that could be used by DPM to increase the number of visitors to the museum by promoting new interactive play activities.

In your answer you **must** consider the following stakeholders and their needs:

- carers and parents
- commercial partners.

Refer to **pages 2 and 3** of the Resource Booklet.

[8]

Most candidates successfully responded to this question.

Critically examining the marketing methods that could be used by DPM to increase the number of visitors to the museum by promoting new interactive play activities clearly appealed to candidates, who were familiar with the expectation of the question.

Candidates mostly used the scaffolding bullet points very well, utilising them as part of both the planning and delivery of their responses.

They had a very good understanding of a wide range of different techniques that could be employed to attract carers and parents. There were many more successful responses that included everything from digital marketing and social media, with direct marketing through algorithms to membership schemes, discounts and family packages.

Some candidates did find marketing to commercial partners more challenging. More successful responses included the use of schools and community groups to undertake joint promotions as well as utilising the brand strength of related companies to garner a wider reach for DPM.

Some candidates did become fixated on one point and focused their response on this, for example only discussing carers and parents. There were also a few candidates that did not respond to the question, omitting marketing methods entirely.

Most candidates used the Resource Booklet effectively, taking the relevant information out of it and presenting it in a way that highlights the problems faced. The best responses were able to use the Resource Booklet to support, justify and exemplify their responses and not just copy out sections.

Level 4 responses gave a comprehensive evaluation that included a range of marketing strategies with both bullet points clearly covered.

Care should be taken with an extended response question that the candidate critically examines and does not simply produce a list the issues. The extended response question is there for the candidate to demonstrate their ability to articulate the suitability of the product for a range of stakeholders.

Specification coverage

Centres are urged to cover all areas that appear in the specification for this endorsement. It was clear that some candidates did not have the relatable knowledge necessary on commercial partners and their relative impacts on the commercial viability of the new interactive play activities.

Question 2*

- 2*** DPM wants to attract families with children, aged 5 to 10 years old, by installing new equipment that provides interactive play activities.

Critically examine the challenges that would be faced in providing and operating new equipment that provides interactive play activities for this age group.

In your answer you **must** consider the following:

- inclusivity
- maintenance
- health and safety.

Refer to **pages 2 and 3** of the Resource Booklet.

[12]

Critically examining the challenges that would be faced in providing and operating new equipment that provides interactive play activities for this age group was often well responded to and it was clear that candidates had a good understanding of the overall context of the question.

Candidates that more successfully responded to this question did use the scaffolding bullet points to good effect, utilising them as part of both the planning and delivery of their responses.

Candidates often demonstrated good knowledge with inclusivity often having detailed responses that included discussions on challenges such as age range relating to physical and cognitive development, accessibility for those children with a variety of disabilities with thoughtful commentary on modifications that might aid inclusion. Maintenance focused primarily on the materials involved, their properties within the new equipment and the impact of the weather with planned checks and remedial works being required. Costs of maintenance and having areas closed if broken or needing replacement parts was also a very popular line of discussion. Health and safety had a myriad of different responses from cleanliness and spreading germs through to trips, slips and falls with compliance and risk assessments often communicated with thorough understanding of the challenges.

Most candidates used the Resource Booklet effectively, taking the relevant information out of it and presenting it to support, justify and exemplify their responses and not just copy out sections.

Level 4 responses gave a comprehensive discussion of all three bullet points, which often included the role of supervision for both parents and DPM.

Some candidates did become fixated on one point and focused their response on this, for example only discussing inclusivity.

Care should be taken with an extended response question that the candidate critically examines and does not simply produce a list of the issues. The extended response question is there for the candidate to demonstrate their ability to articulate the challenges faced providing interactive play activities for the given age group.

Question 3*

3* DPM has an ethical responsibility to consider its environmental impact.

Compare and contrast the environmental impact of the existing outdoor equipment shown in **Fig. 2 and Fig. 3** of the Resource Booklet.

In your answer you **must** consider the environmental impact of the following:

- materials
- manufacturing processes
- surface finishes
- disposal.

Refer to **pages 4 and 5** of the Resource Booklet.

[16]

This question was mostly responded to successfully. Product analysis and comparison is a skill that all Product Design candidates should be familiar with, and it was pleasing to see this evidenced in many responses.

The most successful responses simply worked through the scaffolding bullet points in the question drawing out the relevant information within the Resource Booklet that allowed them to compare and contrast the environmental impact of the existing outdoor equipment. Candidates often summarised with a conclusion at the end of the response. This appears to provide a helpful structure to their responses.

Level 4 responses had a comprehensive examination of the suitability of the two products making full use of the pictorial information and features listed within the Resource Booklet to underpin and support their thoughts. Materials were often clearly explained in terms of their environmental impact within both products, with detailed explanations of the benefits to longevity of melamine laminate plywood as well as the problems then faced with recycling a product that has two materials laminated together. The relative benefits of using nuts and bolts, with semi-permanent fixings aiding disassembly for future uses was oft discussed. Stainless steel versus mild steel in terms of life cycle was also very popular with candidates.

Some candidates were less successful in considering the environmental impact of manufacturing processes. Occasionally candidates did not include any environmental impact whatsoever and some also did not compare the two products against each other.

Most candidates were able to articulate comparisons or similarities between the two products under all four of the scaffolding bullet points.

Exemplar 1

3* DPM has an ethical responsibility to consider its environmental impact.

Compare and contrast the environmental impact of the existing outdoor equipment shown in Fig. 2 and Fig. 3 of the Resource Booklet.

In your answer you **must** consider the environmental impact of the following:

- materials
 - manufacturing processes
 - surface finishes
 - disposal.
- Handwritten notes:*
 melamine plywood
 prioritize steel for structure
 greater surface area
 standard
 both melamine

Refer to pages 4 and 5 of the Resource Booklet.

[16]

Regarding materials, DPM has a responsibility to balance the stakeholder needs with environmental impact. Both Fig. 2 and Fig. 3 employ the use of melamine laminate marine plywood boards - showing that both employ the use of manufactured boards and thermopolymers contributing to a circular economy and reducing environmental impact as such. Fig. 2 uses stainless steel framing compared to Fig. 3 which uses mild steel - stainless steel does not rust/oxidise easily and so finishes are rarely necessary (minimising Fig. 2's environmental impact during manufacture), however Fig. 3's use of mild steel means that it is required to utilize galvanising (a highly energy-consuming process) and powder coating (which poses environmental risk due to toxic chemicals being used) - showing Fig. 2's structural frame has a smaller environmental impact. Also, Fig. 3 uses nylon rope for climbing which is a known endocrine disruptor and potentially harmful to the local environment as it degrades throughout its lifecycle. Alternatively to these points, Fig. 3 appears to use less material overall and per square metre and so makes more efficient usage - minimising environmental impact that way.

Regarding manufacturing processes, Fig. 2 and Fig. 3 have various environmental differences. For instance, Fig. 2 uses tig welding which uses less impactful electrical current and TIG rods to weld the stainless steel frame, whereas Fig. 3 uses MIG welding which is

more environmentally impactful as harmful gases are used to weld the mild iron joints which pose an environmental and air pollution risk to the surrounding environment during welding. ~~Added to the contrary, from face~~ Additionally, from face value, Fig. 2 uses significantly less steel framing compared to the steel-frame in Fig. 3, suggesting Fig. 3 is more environmentally impactful - as steel is highly energy intensive to manufacture and source relative to the marine plywood used in majority for Fig. 2 meaning that Fig. 3 consumes more energy to source and manufacture and therefore likely contributes to carbon emissions through higher energy usage. On the contrary, Fig. 2 uses stainless steel plates which require more complicated manufacturing processes and therefore higher energy impact relative to Fig. 3's manufacture which likely uses extrusion and line/pipe bending for a majority of its structure. With regards to more about surface finishes, the Fig. 3's use of galvanising and powder coating further complicates manufacture and maintenance, more material from the stage of manufacturing to its end of life will be used to maintain the surface finish of Fig. 3, increasing its environmental impact. With regards to disposal, Fig. 3 is much ~~more likely~~ easier to recycle-reuse at that stage due to its construction predominantly being mild steel which can be melted down compared to Fig. 2 which is covered almost entirely in melamine laminated cannot easily be recycled or reused as the laminate is thermosetting and plywood is difficult to recycle due to the toxic adhesives. Not to mention Fig. 3 is generally more difficult to ~~assemble~~ disassemble due to having a larger height making disassembly longer.

This is Level 4 response shows a comprehensive understanding of the **four aspects** specified in the question in relation to the comparing and contrasting of the two products in terms of environmental impacts.

Question 4

4 PG Leisure has been asked to manufacture a geodesic outdoor climbing dome.

Use sketches and/or notes to show how the individual components of the geodesic climbing dome in **Fig. 5** of the Resource Booklet could be manufactured.

In your answer you **must** include details of:

- materials
- methods of manufacture
- accuracy of dimensions.

Refer to **page 6** of the Resource Booklet.

[12]

Candidates often used the scaffolding bullet points to underpin their responses, and we regularly saw all three of them covered to a greater or lesser extent. While materials and manufacturing methods were often very well communicated some candidates were less successful in addressing accuracy of dimensions, either missing it out entirely or giving very cursory detail. Albeit jogs, go/no go gauges, and visual checking were regular responses in higher level responses.

Materials and methods of manufacturing processes have clearly been covered by many centres, with numerous sensible suggestions communicated. Extrusion for the tubing, CAD/CAM, laser cutting, plasma cutting and presswork that included stamping and folding were all used to good effect for the connector plates. Where CAD/CAM was used then accuracy of dimensions was communicated in this part of the response. Candidates were also able to explain how tolerances would be utilised on occasion.

Tessellating components was also popular when laser cutting, which gives rise to the opportunity to discuss the benefits of repeatability with quality control around the accuracy of dimensions.

Surface finishing methods were for the most part clearly understood and the processes, such as galvanising were communicated well.

Level 4 responses had a comprehensive demonstration of all three required areas within the question.

Some candidates did not use the structure of the question to support their response and as such missed out on the details outlined in the bullet point list that were asked to be included in their response.

Supporting sketches were often lacking in detail and in some cases, there were no sketches at all, which would have helped to communicate the points that candidates were trying to make.

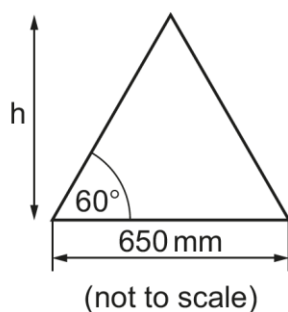
Question 5 (a)

- 5 In order to optimise the dimensions of the climbing board PG Leisure needs to know how many can be machined from a standard size sheet of melamine laminate marine plywood.

During the machining process, the sheet and cut boards will be held in place by the vacuum bed fitted to the CNC router.

- (a) Each climbing board fits within an equilateral triangle as shown in **Fig. 6** of the Resource Booklet.

The equilateral triangle is shown below.

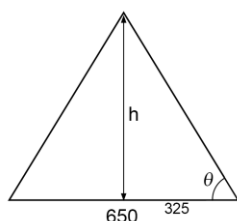


Calculate the height (h) of the equilateral triangle. Give your answer in mm to 2 decimal places and show your working. [3]

Many candidates were given full marks for this part of the Maths question, which was particularly pleasing. Candidates used one of the two possible methods that we have detailed below:

Trigonometry:

Recall of $\tan$ formulae: $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$ [1]



$$\text{opposite} = \tan \theta \times \text{adjacent}$$

Substitute values:

$$h = \tan 60 \times 325 [1] = 562.92 \text{ mm} [1]$$

Where h is the height required, and 325mm is half of the base of the triangle to find this

Pythagoras' Theorem:

Recall of Pythagoras' Theorem: $a^2 + b^2 = c^2$

$$h = \sqrt{c^2 - \left(\frac{b}{2}\right)^2} \text{ where } b \text{ is the base of the triangle and } c \text{ is the hypotenuse}$$

$$h = \sqrt{650^2 - \left(\frac{650}{2}\right)^2} [1] = 562.92 \text{ mm} [1]$$

Question 5 (b)

- (b) Determine the **maximum number** of climbing boards that can be machined from a single sheet of melamine laminate marine plywood.

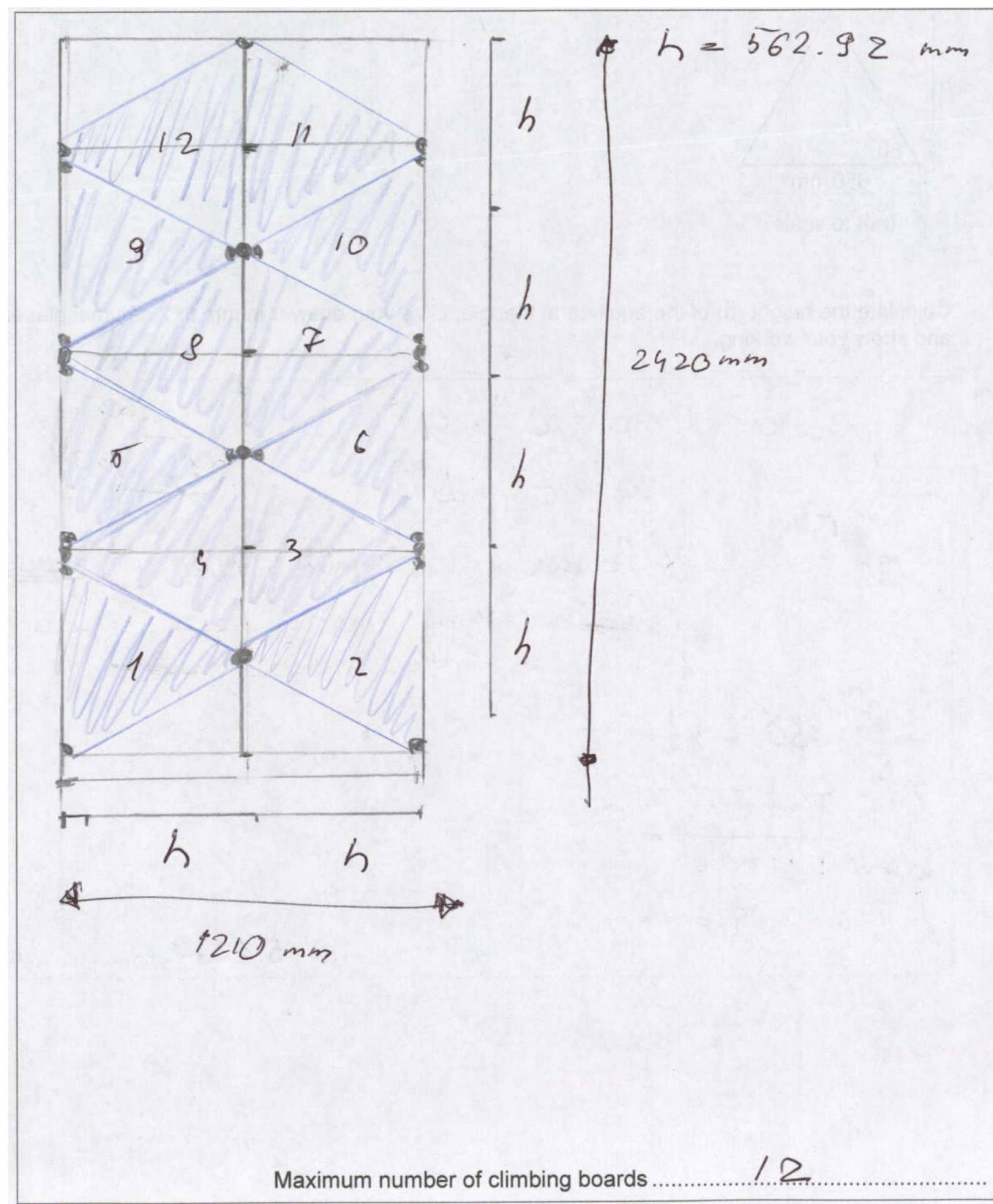
In your answer you **must**:

- include the cutting allowance for the 8 mm diameter router cutting tool
- use your answer from **part (a)** and the data in **Fig. 6** of the Resource Booklet
- show your working including layout sketches.

[3]

Many candidates were less successful in responding to this part of the maths question, even if they had responded to Question 5 (a) correctly.

Exemplar 2



This is a full mark Level 4 response.

Question 6

- 6** The climbing board shown in **Fig. 7** of the Resource Booklet needs a method of attachment to the geodesic frame.

Use sketches and/or notes to show how the climbing board shown in **Fig. 7** of the Resource Booklet could be securely attached to the geodesic frame. It **must** withstand the weight of children climbing on it.

In your answer you **must** include details of:

- manufacturing processes
- materials
- assembly methods
- standard components.

Refer to **pages 7 and 8** of the Resource Booklet.

[16]

This question was successfully responded to by most candidates. Product analysis in relation to assembly methods is a skill that all Product Design candidates should be familiar with, and it was pleasing to see this evidenced in many responses.

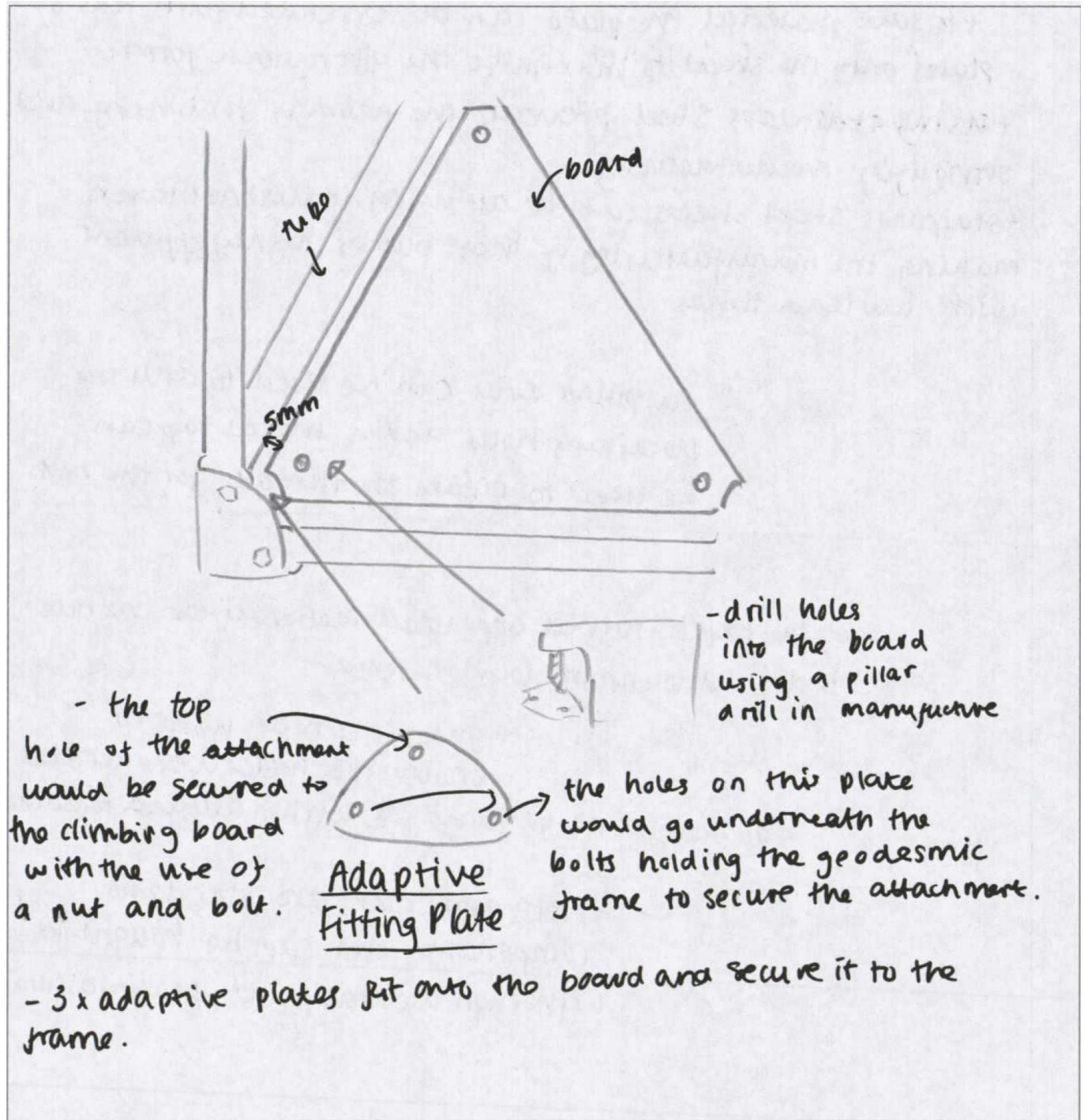
The most successful responses worked through the scaffolding bullet points in order drawing out the relevant information from the Resource Booklet and then fully explaining realistic methods that responded to the problems as set.

Some students unfortunately missed out one bullet point which was somewhat surprisingly manufacturing processes on occasion. Others used inappropriate polymers and polymer manufacturing methods that would not be strong enough to support the weight of children.

Several candidates did not understand the question and simply explained how the two parts would have been manufactured.

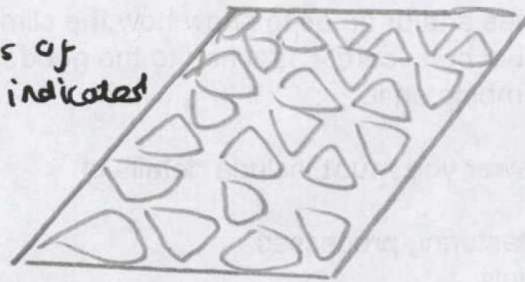
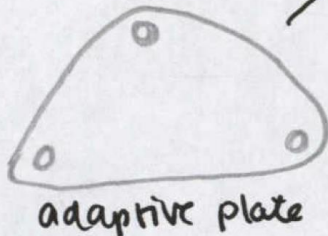
Level 4 responses had a comprehensive set of detailed responses that utilised both clear and detailed sketching and notes to fully articulate how the climbing board could be attached to the geodesic frame.

Exemplar 3



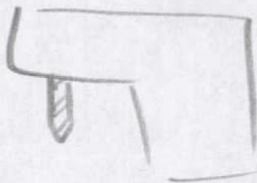
Manufacturing + Materials

the markings of the sheet can be indicated with a marking gauge



sheet of stainless steel in standard sheet stock form

- + to save material the plate can be tessellated with tens of plates onto the sheet to maximise the given stock form.
- + using stainless steel prevents the need of finishing and simplifies manufacturing.
- + stainless steel sheets can be cut using industrial lasers making the manufacturing of these plates highly efficient with low lead times.



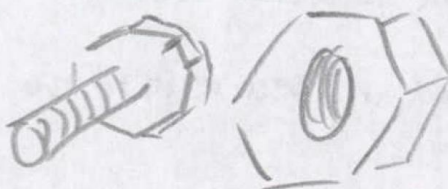
← a pillar drill can be used to drill the necessary holes and a metal tap can be used to create the threads for the bolt.



← the tap is turned opposite direction after the hole is drilled to ensure clean threads.

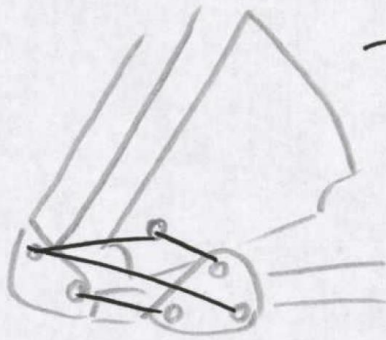
+ gauges can be used to ensure the holes were drilled to within allowed tolerance.

go-gauge no-go gauge



bolts and nuts are standard components and can be bought-in with high accuracy and quality assurance.

Assembly Methods



- the adaptive plate fits over the drilled hole and the holes existing in the frame before assembly. nuts and bolts secure the three layer frame entirely.

Use CAM/CAD for design to improve accuracy of design

This Level 4 response shows a comprehensive understanding of the **four aspects** specified in the question in relation to the problem as set.

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