A LEVEL

Examiners' report

DESIGN AND TECHNOLOGY: PRODUCT DESIGN

H406

For first teaching in 2017

H406/02 Summer 2022 series

Contents

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 are 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 exam paper and the mark scheme can be downloaded from OCR.

Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our website.

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Paper 2 series overview

This is only the second full series for this newly reformed A Level, but examiners were very pleased with the responses from the cohort for H406/02, Problem Solving in Product Design. The candidates appeared to have had a good grounding across this endorsement.

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.

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 examination paper and questions therein.

The recommended reading time for the Resource Booklet is 35 minutes, although it does appear that candidates have spent less time on the booklet to allow more time working on the actual paper. Candidates appear to work through the Resource Booklet in unison with the exam paper, as they work through both documents chronologically.

The total mark for this paper is 70.

The marks for each question are shown in brackets [ ].

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

Candidates often used sub-headings 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 sub-headings when questions asked for responses to include specific bullets points, this was an extremely useful strategy for them to use.

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
- used sub-headings to communicate effectively on extended responses and manufacture/assembly style questions - also used sub-headings when questions asked for responses to use bullet points - used the Resource Booklet to support their responses.	- focused their response on one point in the extended response question - in Question 3, did not address both required stakeholder groups and simply listed marketing strategies without critically examining them - in Question 4, did not use the structure of the question to support their response.

Question 1*

1* A local city council aims to transform the way that residents and workers travel around the city in order to reduce travel congestion and improve air quality.

The councillor for transport and air quality is considering alternative transport options. Two of the options proposed are a bicycle rental scheme and an electric scooter rental scheme.

Critically examine the challenges that would be faced in implementing schemes of this nature.

In your answer you **must** consider the different needs and requirements of:

*   existing road users
*   pedestrians.

Refer to information on **page 2** and **page 3** of the Resource Booklet, specifically **Fig. 1**, **Fig. 2** and **Fig. 3**.   [12]

The vast majority of candidates answered this question very well.

Critically examining the challenges of implementing such a scheme clearly appealed to candidates, who were familiar with the expectation of the question.

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

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

Level 4 responses gave a comprehensive discussion on the challenges faced by both existing road users and pedestrians.

Care should be taken with an extended response question that the candidate enters a discussion of the challenges and not simply produce a list the issues. The extended response question is there for the candidate to demonstrate their ability to articulate the challenges faced by the given stakeholders.

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

Question 2*

2* The council needs to assess the feasibility of operating an alternative transport scheme themselves or using a contractor.

Two of the options proposed are a bicycle rental scheme and an electric scooter rental scheme.

Compare and contrast the suitability of the existing products shown in **Fig. 4** and **Fig. 5** of the Resource Booklet for the proposed rental schemes.

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

- ergonomics
- required maintenance
- planned obsolescence.

Refer to information on **page 3** and **page 4** of the Resource Booklet, specifically **Fig. 4** and **Fig. 5**. **[12]**

This question was particularly well answered. Product analysis and comparison is a skill that all Product Design candidates should be familiar with and this was evident throughout.

The best responses simply worked through the scaffolding bullet points in the question drawing out the relevant information within the Resource Booklet comparing the relative strengths and weaknesses of the electric scooter and bicycle and then summarised with a conclusion at the end of the response. This provided a good structure to their response.

Level 4 responses had a comprehensive examination of the suitability of the two products making full use of the specifications listed within the Resource Booklet to underpin and support their justifications.

Most candidates identified the main ergonomic factors outlined in the Resource Booklet.

The more successful responses considered extra ergonomic factors and the respective differences in terms of planned maintenance.

A significant number of candidates did not appear to fully appreciate the role of planned obsolescence. This point was often not included in responses. A small number of candidates misunderstood material properties relating to stainless steel and aluminium, as neither will rust.

Question 3

3   The council needs the e-scooter rental scheme to be successful and it is therefore considering the overall marketing strategy for this service.

Critically examine the methods that could be used to create and increase demand for the e-scooter rental scheme.

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

- the council
- customers.

Refer to information on **page 4** and **page 5** of the Resource Booklet, specifically **Fig. 6** and **Fig. 7**.   **[8]**

Generally, a well answered question with many candidates having a very clear and well considered understanding of how to create and then increase demand for the e-scooter rental scheme.

There was inevitably a great deal of focus on the use of social media to create and increase demand with specific examples of Instagram, Tik-Tok and Influencers as well as celebrity endorsements being regularly cited. There were also some insightful responses considering the use of discounts/loyalty schemes, with the value of product placement and penetrative pricing strategies also utilised often.

Level 4 responses justified their choice of marketing strategy linking it directly to the demographic and potential associated costs, extracting information directly from the Resource Booklet to further exemplify.

On occasion candidates did not address both required stakeholder groups and simply listed marketing strategies without critically examining them. It was also noticeable that candidates also covered the creation of demand and sometimes did not then refer to their strategies for increasing it further.

Question 4

4   Products such as the junior school scooter stand shown in **Fig. 8** of the Resource Booklet undergo quality control during manufacture to check that they meet the technical specification and satisfy manufacturing tolerances.

Use sketches and/or notes to show suitable methods of ensuring consistent accuracy and quality if 250 junior school scooter stands were commercially manufactured.

In your answer you **must** include references to the following:

- jigs and templates
- visual checks
- accuracy of dimension checks
- digital manufacturing.

Refer to information on **page 6** of the Resource Booklet, specifically **Fig. 8**.   **[16]**

This question proved to be challenging with some candidates finding the use of quality control procedures within a manufacturing scenario difficult to navigate. A number went into great detail about the specific manufacturing methods that could be used to produce the scooter stands rather than ensuring consistent accuracy and quality.

Those candidates that responded correctly did so with lots of detail. Level 4 responses had a comprehensive demonstration of the manufacturing processes linked intrinsically to quality control through the four clear scaffolding bullet points. They showed very good awareness of how jigs and templates can be utilised for accuracy and repeatability. Digital manufacturing came through very strongly throughout, with dimensional accuracy, repeating common parts and the increases in accuracy the machines afford when human error is removed offered regularly.

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 occasionally lacking in detail.

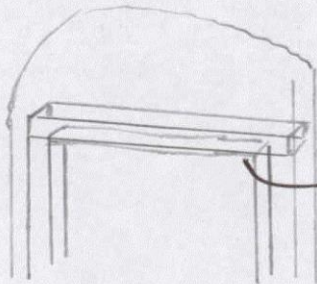Please see Exemplar 1 below, which was a Level 4 response.

Exemplar 1
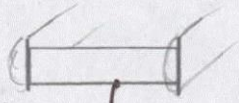
Accuracy check, width between support brackets making sure each gap is consistent and to the correct dimensions, simply using a measured slot of material.
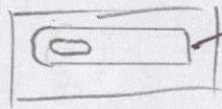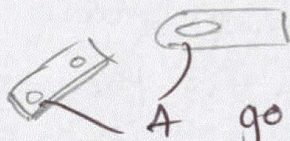
Support bracket template to ensure dimensions are accurate and each bracket is the same. Placed onto sheet metal the cut.

welding jig to hold bracket in place for welding, ensures bracket is welded at the same height, in the same place as required to the tech spec.
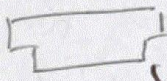
A go-no go guage can be used to check diameter/width of both the foot of the scooter stand and the support bracket to check accuracy and is within tolerance of technical specification.

Visual inspection of welds, to make sure they are up to standard and meet quality. Checking for defects in the material, looking for consistency across the materials.

jig can be used as as a spacer to ensure gap between brackets are the same, can also be used to secure brackets in place whilst welding - welding jig.
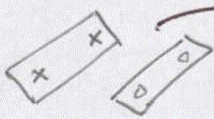
template with pre drilled hole or marking holes can be placed over material fit. as a drilling template.
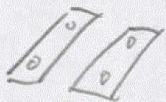
—visual check to make sure holes are drilled correctly and any burr has been removed, checking against a correct product, making sure hole line up if placed on top on one another.

Accuracy check, dimensions correct to technical specification every 1 in 10 within the batch, dimensions checked for within tolerance of specification
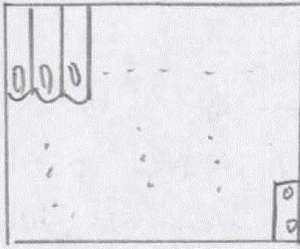
Making use of CNC plasma Cutter or if material is thin enough then a laser Cutter to utilize computer aided design into computer aided manufactur to ensure accuracy and consistency. Designed on the computer to technical specification dimensions to then cut using CNC.

Also allows for tesselation and the removal of waste. this ensures accuracy reducing the need for quality checks and little machining.

laser input
part
detector
laser
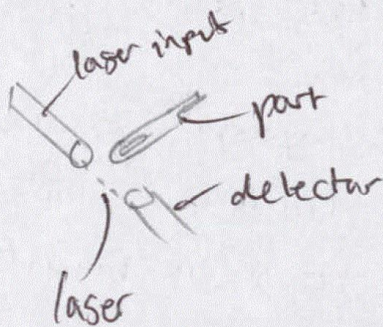
digital technology used to measure dimensions, detecting irregularities and ensuring accuracy of dimensions within tolerances.

Digital technology removes human error, increases accuracy. This could be implemented for the welding process, digital technology combined with software to get consistent welds of the same quality.

Exemplar 1 clearly demonstrates methods for affording consistent accuracy and quality if the scooter stands were to be commercially manufactured in a batch of 250. Within the response all four of the scaffolding bullets points are used comprehensively, as the candidate works through the manufacture of each individual components.

Question 5

5   The manufacturer, 'Stand-up', is considering the commercial viability of the e-scooter stand.

As part of its cost analysis, the weight of the stand needs to be calculated.

Use the information in **Fig. 9** of the Resource Booklet to calculate the weight in g of the curved tube used in the e-scooter stand. Give your answer to **2** decimal places and show your working.

[6]

The majority of candidates were able to correctly apply the formula to calculate arc length using a radius of 225 mm, however candidates rarely spotted that the radius should be taken from the centre of the tube as detailed in the mark scheme.

Candidates followed a logical route to their response, first calculating an arc length, followed by the length of the tubes, cross sectional area, volume and finally density.

Candidates often correctly identified how to calculate the cross sectional area of the tube.

For future series candidates should be encouraged to only round their calculations to two decimal places for their final response. All calculations leading up to this point should remain in full, not rounded.

Question 6

6 The designer has developed a concept design for an e-scooter station called Eco-shelter, shown in **Fig. 10** and **Fig. 11** of the Resource Booklet.

Use sketches and/or notes to outline suitable methods of manufacture and assembly for the features of the concept design taking account of the fact the council will require an initial quantity of 50 shelters.

You **must** focus on all parts of the concept design including the roof, timber frame and ground brackets.

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

- specific materials
- manufacturing processes
- finishes
- assembly methods.

Refer to information on **page 7** and **page 8** of the Resource Booklet, specifically **Fig. 10** and **Fig. 11**.   **[16]**

Where candidates had allowed enough time, this question certainly seemed to appeal with many candidates giving fulsome responses with some logical and sensible detail. Candidates often used the scaffolding bullet points to underpin their responses and we regularly saw all four of them covered to a greater or lesser extent.

Materials and manufacturing processes have clearly been covered by many centres, with many sensible suggestions communicated. There was a wide variety of timbers for the frame, various polymers for the roof and brackets that either allowed for the outdoor nature of the shelter or clearly explained that a coating would be needed for protection.

Steam bending, presswork, and digital manufacture, including minimising waste in manufacture all came through strongly. Common parts and tessellating components were also popular.

Assembly methods ranged a little but again many candidates developed responses that included logical ideas that would allow for flat packing, which often included physical joints within the frame structure.

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

Some candidates did not use the structure of the question to support their response and as such either did not include details on each component within the shelter or 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.
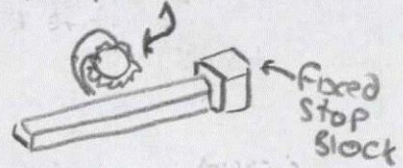
Please see Exemplar 2 which is a Level 4 response.

Exemplar 2

Timber frame

+ Most likely made from a hardwood like beech because of its naturely resistant Properties

manufacture

① Firstly the wood is cut to size from its standard sizes, this is done using a Jig Stop block on a mitre/chop saw to ensure each piece is at the correct length

← Fixed Stop Block

② Next the relevent pieces are steam bent to create the desired curve.
This is done by putting the wood in a sealed box filled with steam leaving them to fill with moisture

Steam   Cut wood   sealed door

Clamps

Jig

wood piece
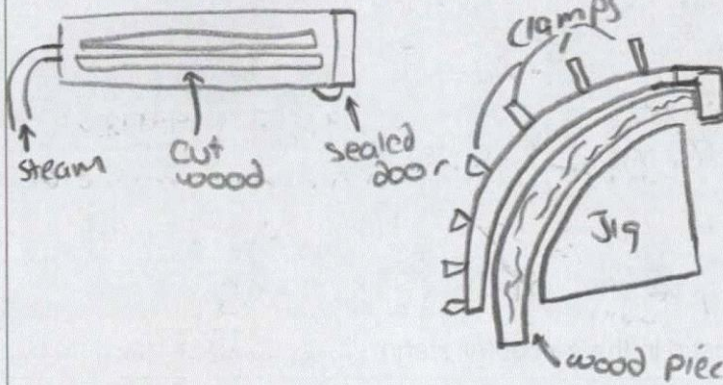
③ after the wood is ready to be bent, they are removed one at a time and put in the bending jig. a stop block is used to ensure the bend is in the correct place and then the jig is secured to the wood using clamps and is left to cool

④ This is repeated to make the 3 back sections and a different jig is used to ~~install~~ bend the front 2 pieces

Clamps → Piece
Jig
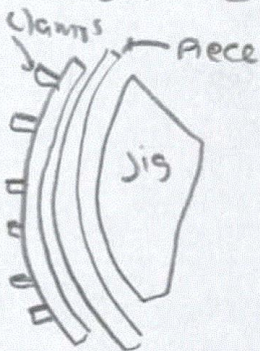
⑤ the steam bending may need to occur multiple times to ensure the wood keeps its required shape

⑥ then to make the back horizontal structs a half lap of joint is made in the curved wood and ~~the struts~~ Strut

↑ Chiseled out by hand

Chiseld by hand using a template piece as reference
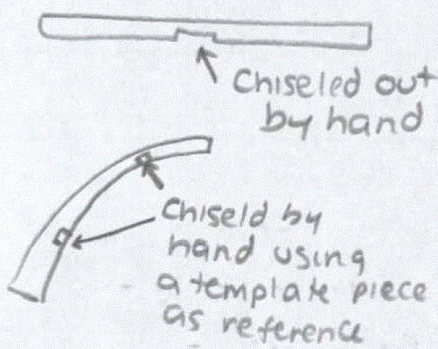
⑦ next the cross ~~bar~~ braces are cut on a 45° angle and holes are drilled in the end to accept a dowel (because its flat packed)

Drill Press
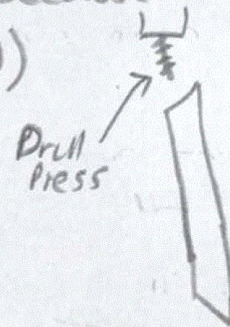
⑧ finally everything is finished in a teak oil to ensure it resists the weather

6.5 the ends of the bracing and the side of the bent frame are given a mortise and tenon joint

this would be done by hand using a drill, chisel and a tenon saw

Mortise and tenon

Roof

(PP)
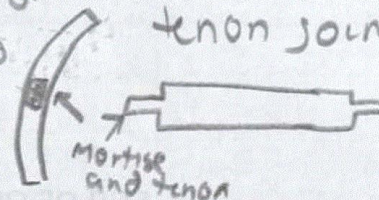
+ the roof is made of a ~~this~~ layer of polyproplene as it is avaible in clear and can be bent.

manufacture

the roof would simply be cut to size on a table saw from the standard size it was purchased in

PP   table saw
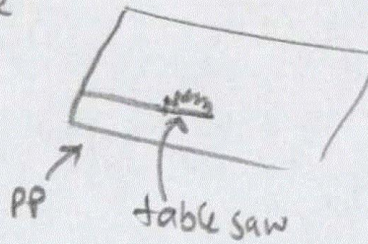
finish

The roof doesn't need to be finished as PP is self finishing but it may be cleaned to remove dust

assembly

To assemble to frame small pins will be provided to be hammered onto the structs and frame as well as some optional glue to further secure the PP to the frame

Pin here

and along here
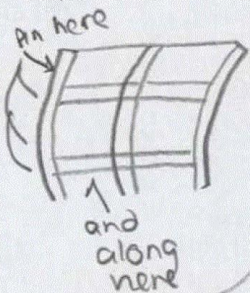
Ground Brackets - made from a ~~low~~ carbon steel
lower

① metal is cut to size from its ~~sq~~ purchased size using a hacksaw (after being measured)
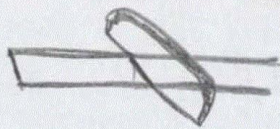
② 3 holes are drilled using the drill press and a drill & Jig
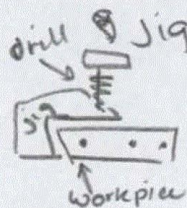
③ Brackets are heated then bent into 90° by a jig

lifts up to bend folded

Bends upward

Workpiece
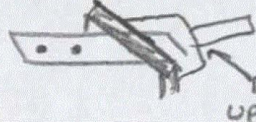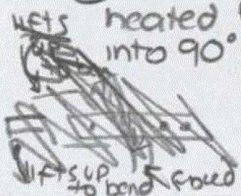
Exemplar 2 clearly demonstrates how the candidate has worked through the methods of manufacture and assembly of the Eco-shelter systematically, using the scaffolding bullet points to support their responses within each individual component as they communicate an end to end operation.

Specification coverage

Centres are urged to cover all material areas that appear in the specification for this endorsement. It was clear that some candidates did not have the necessary knowledge of woods.

If centres do not have direct access to specific machinery, then utilising information available via YouTube for instance can be helpful.

Sketching skills, whether in two or three dimensions, did not always fully support the level of communication candidates really needed for this style of question. This is another skill that can be approached across the endorsement and will benefit them within their NEA and examinations.

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