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OCR
Oxford Cambridge and RSA

A LEVEL

Examiners' report

DESIGN AND TECHNOLOGY: PRODUCT DESIGN

H406

For first teaching in 2017

H406/02 Summer 2024 series

Version 1

ocr.org.uk/designandtechnology

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 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 OCR.

Paper 2 series overview

We were 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 this endorsement and found the 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 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 examination 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 had scaffolding that 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:	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 sub-headings 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 • fixated on one aspect of a question only • found communicating their responses where sketching would have been helpful challenging.

Question 1*

1* Videotech product designers have developed a concept design for an entry level product called iStand. This is shown in **Fig. 2** of the Resource Booklet.

The designers need to consider the viability of the iStand concept design for a range of stakeholders to make home videos.

Critically evaluate the suitability of the iStand for a range of stakeholders to use a mobile phone to make home videos.

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

- stakeholder needs
- function
- health and safety.

Refer to information on **pages 2 and 3** of the Resource Booklet. **[12]**

Most candidates answered this question very well.

Critically evaluating the suitability of the iStand for a range of stakeholders 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 good understanding of the suitability of the iStand in relation to the all-important three bullet points that are afforded for candidates to frame their response with. Stakeholder needs and function, were clearly understood and articulated for the most part, albeit health and safety proved more of a challenge for some candidates.

Some candidates did become fixated on one point and focused their response on this, for example only discussing ergonomics. There were also many candidates that mixed up stakeholder needs and function, the value of working under sub-headings that directly link to the scaffolding bullet points cannot be underestimated in terms of supporting the thought processes of candidates as they formulate 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 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 stakeholders with all three bullet points clearly covered.

Care should be taken with an extended response question that the candidate critically evaluates 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.

Question 2

2 Videotech is keen to bring the iStand to market.

As part of the development process, the designers need to carry out quality assurance on the prototype stand.

Products such as the stand in **Fig. 2** of the Resource Booklet undergo testing in order to check that they meet the technical specification and British Standards.

Discuss suitable methods of testing the stand.

In your answer you **must** include:

- testing for accuracy
- testing of materials.

Refer to information on **page 3** of the Resource Booklet. **[8]**

Discussing suitable methods for testing the stand was somewhat of a challenge for many candidates. While they appeared familiar with testing as a general concept, they often found it difficult to relate their thoughts to the product.

Candidates that answered well did use the scaffolding bullet points to good effect, utilising them as part of both the planning and delivery of their answers.

Those candidates with a good understanding of suitable methods of testing the stand were able to directly link testing of accuracy via dimensional checks, with examples of equipment, sampling and use of tolerances to explain an acceptable range as well as CAD and data comparison. Testing of materials ranged from the checking of material quality thorough to accelerated testing, drop tests and x-rays.

Go/no go gauges and visual checking were also popular responses.

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 discussed both accuracy and materials in detail and linked directly to the product.

Some candidates did become fixated on one point and focused their response on this, for example only discussing materials or accuracy rather than both.

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 always have the knowledge necessary to relate testing directly to a product.

Question 3

3 Designers at Videotech have undertaken a feasibility study of the iStand concept design in **Fig. 2** of the Resource Booklet.

The results indicate that a reduction in cost is required and modifications should be made to the design to minimise materials and components.

Use sketches and/or notes to show how the iStand concept design in **Fig. 2** of the Resource Booklet could be manufactured.

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

- modifications to minimise materials and components
- methods of manufacture
- surface finishes.

Refer to information on **page 3** 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.

Modifications to minimise materials and components was regularly linked to DFMA with many candidates having a good grasp of how to reduce the material within the iStand without compromising structural integrity. The hinge was often reduced to a much smaller standardised component, removed entirely or incorporated within the actual product similar to a living hinge.

Triangulation was often well communicated.

Unfortunately, a number of candidates ignored the modifications aspect within the question and simply discussed the manufacture of the product in its current form, which impacted on their overall mark for this question.

Methods of manufacturing processes have clearly been covered by many centres, with numerous sensible suggestions communicated. CAD/CAM, laser cutting, plasma cutting and presswork that included stamping and folding were all used to good effect. Where a candidate removed the hinge entirely and subsequently changed the material to a thermo-plastic, we saw some excellent responses that also negated the need for a surface finish, thus minimising processes still further.

Tessellating components was also popular when laser cutting and press work was being offered as a route to manufacture.

Surface finishing methods ranged a little, with some candidates simply stating that anodising would be used and then not going into any detail about the process. Those candidates that explained why they would move to powder dip coating clearly understood the process and answered well.

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.

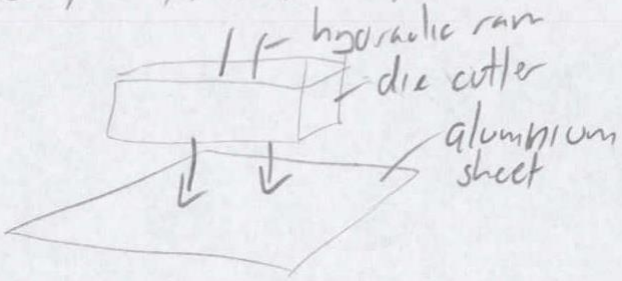
Supporting sketches were often lacking in detail.

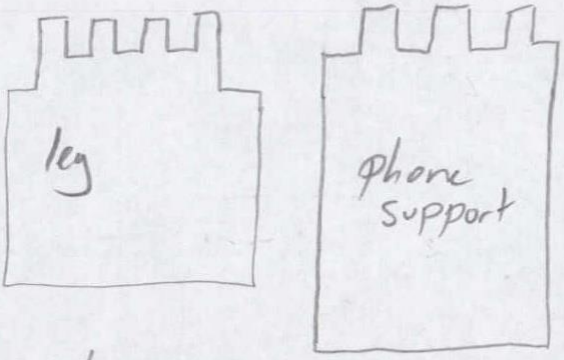
Please see Level 4 exemplar below.

Exemplar 1

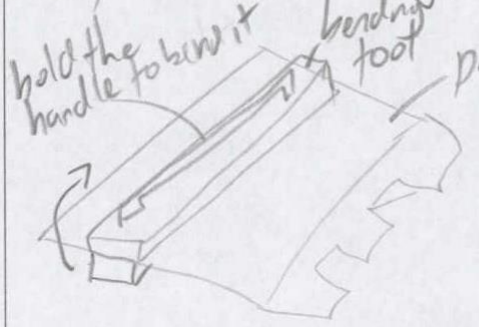
Remove stainless steel hinge - instead, increase length of aluminium, bend it over, & insert stainless steel rod to form a hinge.

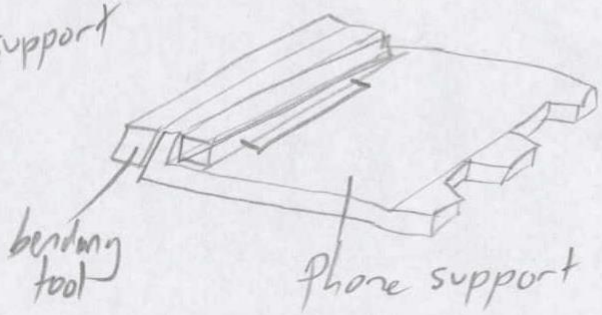
Stamp die cutting:
Get a sheet of aluminium & place it in the press forming machine a hydraulic press pushes a die cutter down to cut out the shape of the two plates

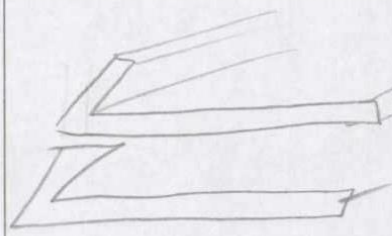




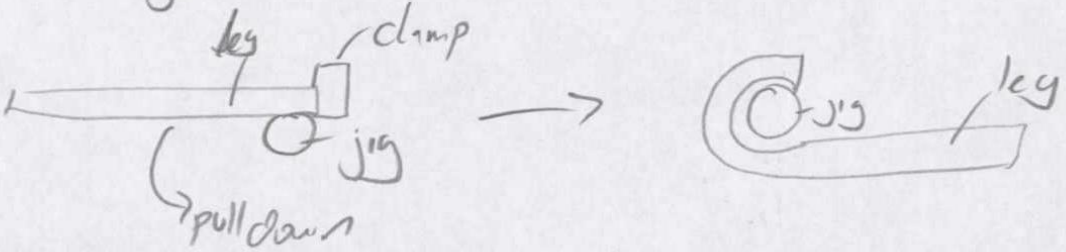
Use a bending machine to bend the sides of the leg over & the base of the phone support over to the correct shapes - using a jig to ensure the correct angles



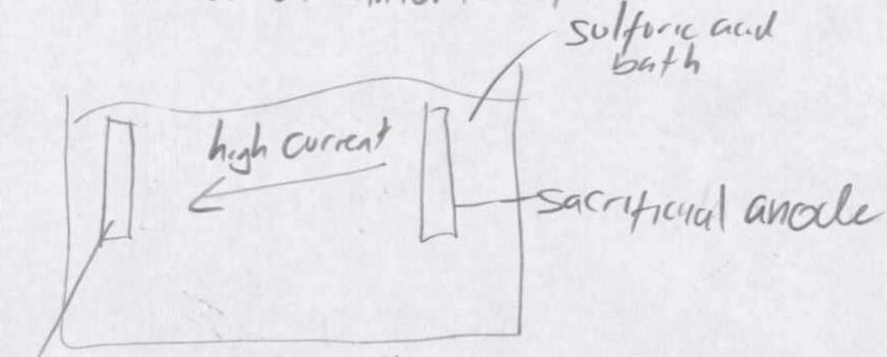




Hinges:
clamp the hinge end of the phone support & leg in a vice and pull down over a jig to curve the end around to create a hinge

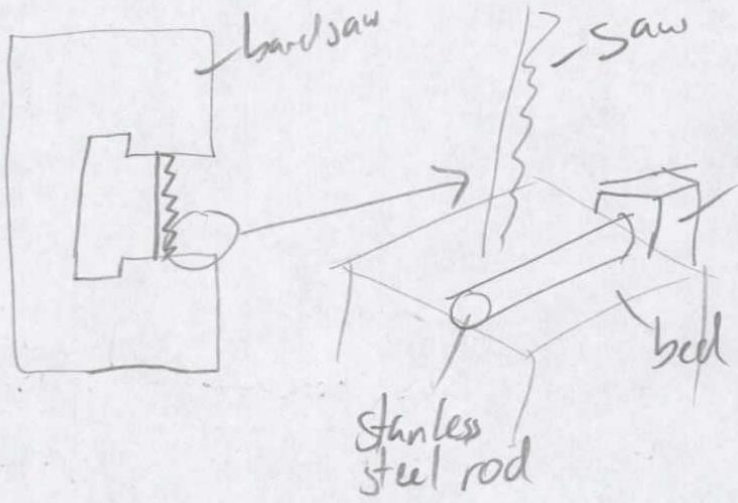


Surface finish:
anodised aluminium -> parts should first be cleaned & de-greased

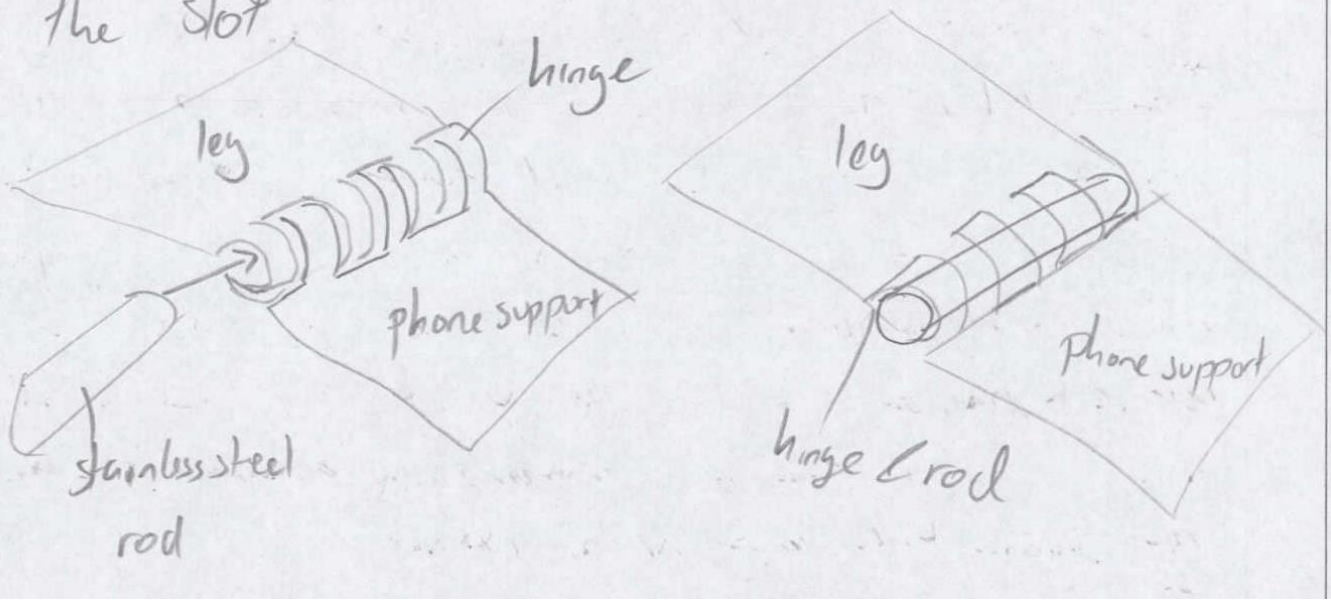


The high current & sacrificial anode causes a thickening of the aluminium oxide layer, colour can also be added at this point.

Get a stainless steel rod that outside diameter is the same as the hinges inside diameter.
Cut it down to the same length as the hinge using a bandsaw.



Slot the leg & the phone support together via the hinge part & insert the stainless steel rod through the slot



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

Question 4*

4* Videotech designers want to move away from users needing a number of products such as the examples shown in **Fig. 3** of the Resource Booklet towards a more compact integrated solution.

Compare and contrast the suitability of the existing Vizion products shown in **Fig. 4** and **Fig. 5** of the Resource Booklet for the use of vlogging.

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

- ergonomics
- functions
- required maintenance
- planned obsolescence.

You will need to use information on **pages 4–6** of the Resource Booklet. **[16]**

This question was for the most part well answered. 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 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, weaknesses and similarities of the Vizion products 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 pictorial information and features listed within the resource booklet to underpin and support their justifications.

Most candidates were able to identify ergonomics and function in detail when comparing the two products. However, as with Question 1, sometimes students mixed them up, and they should be encouraged to answer using the bullet points as sub-headings to help clearer communication of their thoughts.

A number of candidates did find comparing the two products in terms of required maintenance and planned obsolescence a challenge. Occasionally not including one or either in their responses.

Higher achieving candidates considered the respective differences in terms of required maintenance and planned maintenance.

Please see Level 4 exemplar below.

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 required maintenance or planned obsolescence.

Exemplar 2

Both have similar functions regarding the ergonomics of the products. The design in Fig. 4 have ~~telescopic~~ adjustable height of up to 23cm approx compared with the adjustability of the telescopic pole with height adjustment ranging across ~~150mm~~ 160mm and 600mm. Higher adjustability means it is inclusive for wider range of people thus ergonomically more suitable. Both design have similar design for phones holders allowing approximately 3cm of adjustability thus both are suitable.

Regarding function, both designs in Fig 4 and 5 have very similar base functions. Both design have ~~to~~ two phones holders with one being able to pivot sideways and both have an adjustable lighting. The design in Fig. 5 have an LED light with 3 colour theme and 5 brightness level whereas the design in Fig 4 only have 3 colour themes but no adjustable brightness thus Fig 5 design is more suitable. Also being the compacted version, design in Fig 5 have a function not present in Fig 4 design. Compacted storage

Fig 5 design have a counterweight/base that also serve as storage... ~~the~~ This function ~~is~~ makes Fig 5 more suitable logging tool as it is compatable for storage and & portability with a generally ~~so~~ cleaner aesthestic.

However due to addition functions on the Fig 5 design more maintenance would be needed compared to Fig 4 design. Fig 4 design, which is largely mechanical and manual avoids the maintenance issues as it ~~just~~ has functions mostly visible thus easier to fix/to find. The telescopic pole design and pivoting shaft ~~are~~ is hidden, meaning if there was a ~~clogs~~ ~~it~~ clog stopping extension/retration it cannot be fixed only replacement. This also means the planned obsolescense for Fig 5 ~~design~~ design will be shorted than Fig 4 design.

Due to the additional ~~motion~~ function and USB ~~to~~ charging method the Fig 5 design will have a small planned obsolescense time as there are more parts ~~to~~ that could not be replaced. The complexity of design also means it is less likely to be fixed. Also with the pole being zinc alloys oxidisation is likely to be sooner than the aluminium alloy pole of Fig 4. Zinc is ~~an~~ a highly reactive metal thus suitability considering ~~need~~ maintenance and planned obsolescence, Fig 4 is more suitable.

Higher achieving candidates considered the respective differences in terms of required maintenance and planned maintenance.

Question 5 (a)

5 In response to user feedback Vizion is considering increasing the weight of the cast iron base of the Live Stand to improve stability for use with some heavy phones.

In order to assess the feasibility of this change, designers need to know the new volume of cast iron.

(a) For the cast iron base shown in **Fig. 6** of the Resource Booklet:

Determine by calculation that the volume of the hole is 5498 mm^3. Show your working.

The formula for the volume of a cylinder is $\pi r^2 h$

Assume the volume of the small cylinder is 785.39816 mm^3.

Refer to information on **page 7** of the Resource Booklet. **[3]**

Large cylinder volume = π x 102 x 15 [1] = 4712.38898 *[1]

Volume of hole = small cylinder volume + large cylinder volume

= 785.39816 + 4712.38898 *= 5497.78714 mm3= 5498 mm3 [1]

Alternative approach:

pi x 10^2 x 15 = 1500 pi = 4712.38898 [1]

785.39816 = pi x 5^2 x 10 = 250 pi [1]

1500 pi + 250 pi = 1750 pi = 5498 [1]

A significant number of candidates were able to determine by calculation the given volume of the hole with the two examples shown above being the most popular routes.

Question 5 (b)

(b) The cast iron base in **Fig. 6** of the Resource Booklet is a truncated cone.

Calculate the volume of cast iron in mm^3. Show your working.

Refer to information on **page 7** of the Resource Booklet. **[3]**

Volume of cast iron ..... mm^3

$$Volume\ of\ the\ truncated\ cone$$

$$= \frac{1}{3}\pi h(Rr + R^2 + r^2) = \frac{1}{3}\pi 25\left((150X140) + 150^2 + 140^2\right)$$

= 1651954.137 [1]

Volume of cast iron = volume of truncated cone – volume of hole = 1651954.137* – 5498 [1]

= 1646456.137* OR 1646456* mm3 [1]

With the formula given many candidates found accessing the first mark achievable.

Many candidates were also able to subtract the volume of the hole to arrive at the final correct response.

Question 6

6 Artificial intelligence (AI) has created a concept model of a vlogging stand, suitable for use by dancers for social media videos.

In order to lower transportation and storage costs the manufacturer needs the final product to be flat-packed and weigh as little as possible.

Use sketches and/or notes to outline suitable methods of assembly for the vlogging stand in **Fig. 7** of the Resource Booklet to be suitable for flat-pack distribution to retailers and customers.

In your answer you **must** address the following problems:

- The phone holder requires a method of attachment to the top of the pole.
- The legs will scratch hard floors and may damage carpets.
- The legs need a method to stop them opening too far.
- The post requires a method of locking and unlocking it while allowing for adjustment of height.

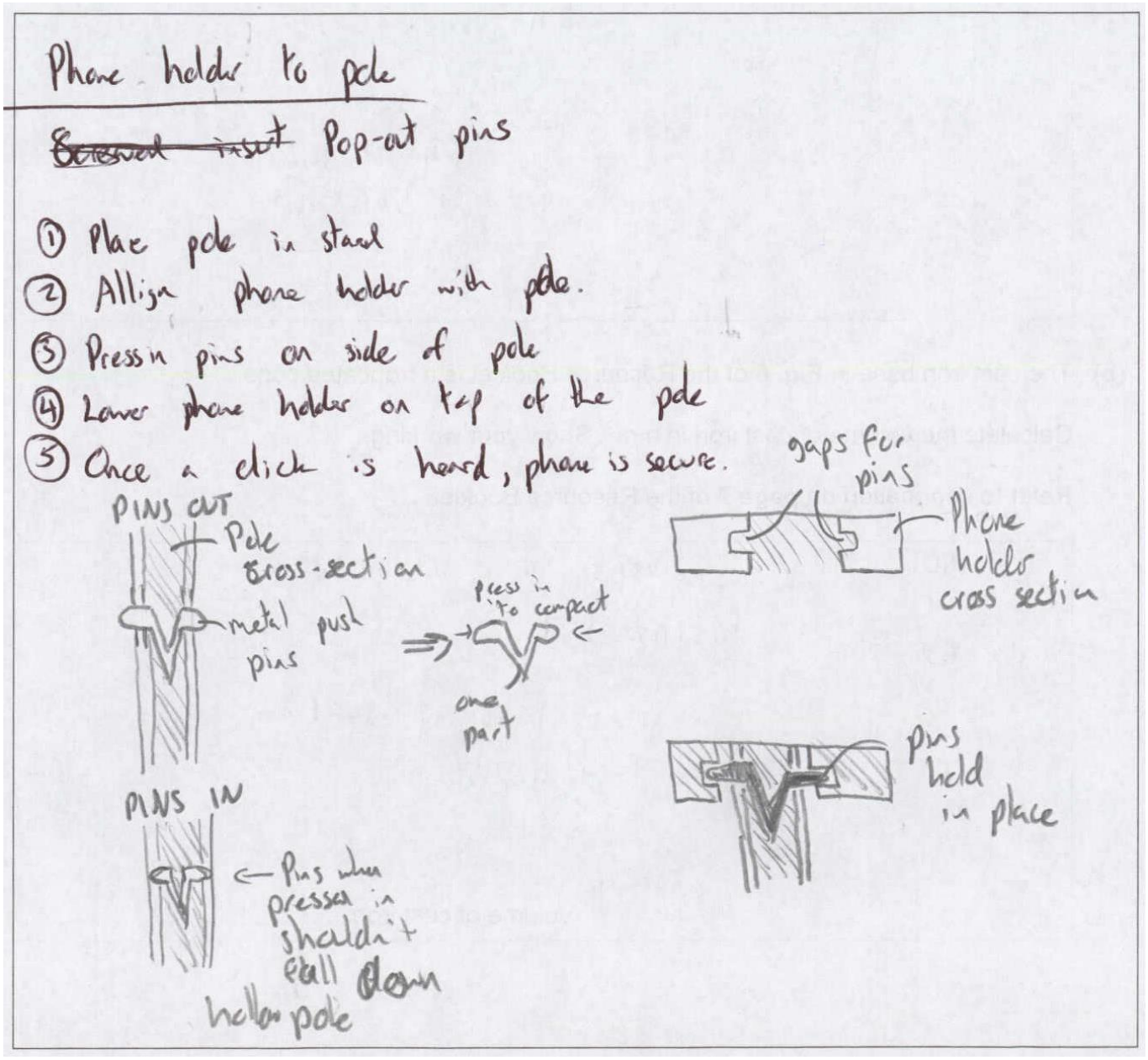
Refer to information on **page 8** of the Resource Booklet. **[16]**

This question was for the most part well answered. Product analysis in relation to assembly or disassembly is a skill that all Product Design candidates should be familiar with, and it was pleasing to see this evidenced in many responses.

Full responses worked through the scaffolding bullet points in order drawing out the relevant information within the resource booklet and then fully explaining realistic assembly methods that responded to the problems as set.

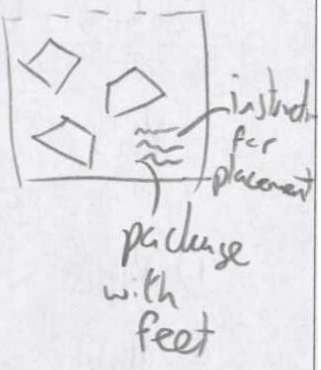
Some students unfortunately missed out one bullet point or indeed didn't consider the flatpack nature of the context as well as discussing how the product/components would be manufactured, which was not required within this question.

Exemplar 3

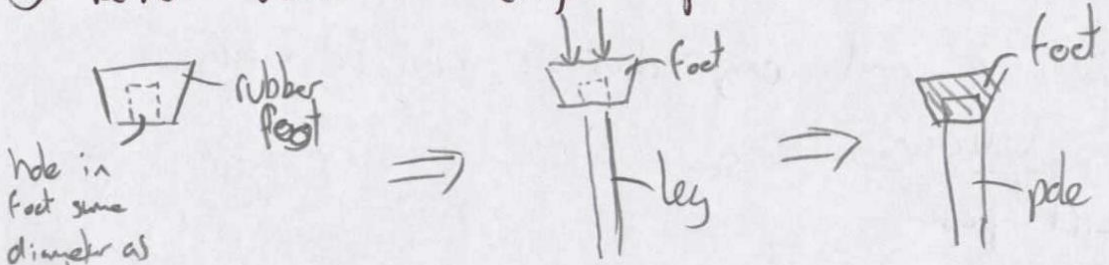


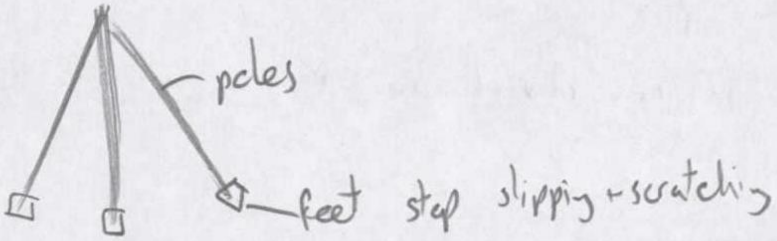
Leg scratchings

Rubber feet



1. Flip over stand so legs point up-right
2. Remove feet from packaging
3. Press firmly onto legs - one at a time
4. Will press on and hold with friction
5. Revert stand to original position.

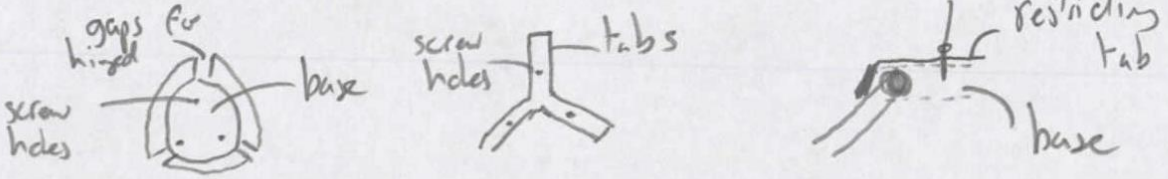




Legs opening too far

~~Restrictor clips~~ Restricting tabs

1. Place the tabs on the platform at the top
2. Allign tabs with gaps in leg hinges → using provided allen key
3. Secure down with 3 allen head screws



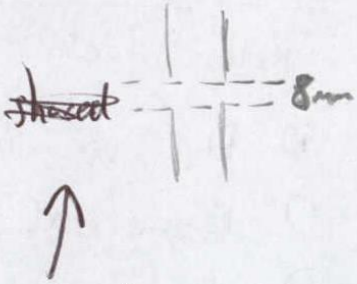
~~EACH PART IS PACKAGED~~

Screw x3

Allen head M4 screws to attach pieces together

Locking + Unlocking Post

Pins

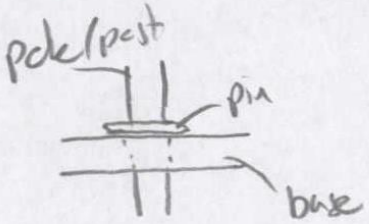


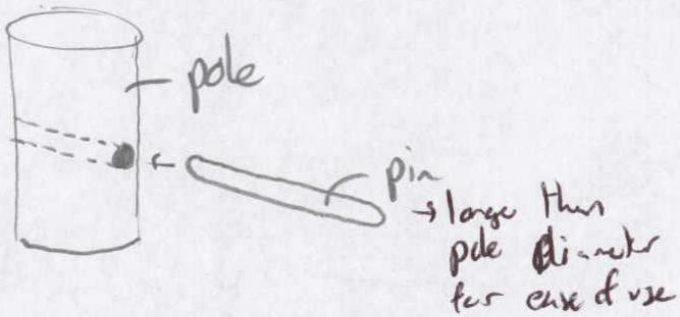
LOCK

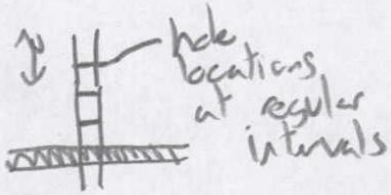
1. Place post in stand
2. Hold at desired height + place pin in holes
3. Gently lower until pin is pressing against the base
4. Let go and any adjustment can be made

UNLOCK

1. Lift post
2. Remove pin
3. Lock in new desired height







This Level 4 response had a comprehensive set of detailed responses to the four problems with the pictorial information within the resource booklet to underpin and support their justifications.

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What are our online courses?

Our online courses are self-paced eLearning courses designed to help you deliver, mark and administer internal assessment for our qualifications. They are suitable for both new and experienced teachers who want to refresh their knowledge and practice.

Why should you use our online courses?

With these online courses you will:

- learn about the key principles and processes of internal assessment and standardisation
- gain a deeper understanding of the marking criteria and how to apply them consistently and accurately
- see examples of student work with commentary and feedback from OCR moderators
- have the opportunity to practise marking and compare your judgements with those of OCR moderators
- receive instant feedback and guidance on your marking and standardisation skills
- be able to track your progress and achievements through the courses.

How can you access our online courses?

Access courses from Teach Cambridge. Teach Cambridge is our secure teacher website, where you'll find all teacher support for your subject.

If you already have a Teach Cambridge account, you'll find available courses for your subject under Assessment - NEA/Coursework - Online courses. Click on the blue arrow to start the course.

If you don't have a Teach Cambridge account yet, ask your exams officer to set you up – just send them this link and ask them to add you as a Teacher.

Access the courses **anytime, anywhere and at your own pace**. You can also revisit the courses as many times as you need.

Which courses are available?

There are **two types** of online course: an **introductory module** and **subject-specific** courses.

The introductory module, Building your Confidence in Internal Assessment, is designed for all teachers who are involved in internal assessment for our qualifications. It covers the following topics:

- the purpose and benefits of internal assessment
- the roles and responsibilities of teachers, assessors, internal verifiers and moderators
- the principles and methods of standardisation
- the best practices for collecting, storing and submitting evidence
- the common issues and challenges in internal assessment and how to avoid them.

The subject-specific courses are tailored for each qualification that has non-exam assessment (NEA) units, except for AS Level and Entry Level. They cover the following topics:

- the structure and content of the NEA units
- the assessment objectives and marking criteria for the NEA units
- examples of student work with commentary and feedback for the NEA units
- interactive marking practice and feedback for the NEA units.

We are also developing courses for some of the examined units, which will be available soon.

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