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Examiners' report

DESIGN AND TECHNOLOGY: PRODUCT DESIGN

H406

For first teaching in 2017

H406/01 Summer 2023 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 answers 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 1 series overview

This component is the first of two examined components and makes up a quarter of the total A Level qualification.

This paper is set out through four sets of questions that cover technical principles within Product Design. Questions require candidates to:

- analyse existing products
- demonstrate applied mathematical skills
- demonstrate their technical knowledge of materials, product functionality, manufacturing processes and techniques
- demonstrate their understanding of wider social, moral, and environmental issues that impact on the design and manufacturing industries.

To do well in this component candidates need to analyse modern consumer products that are designed to meet consumer needs, their design and manufacture, and show understanding of product development and commercial practices. Candidates are tested on a range of materials and components used in the manufacture of commonly available products, as outlined in the specification.

Candidates need to show clear understanding of topics through extended written responses, and support discussions with evaluation and use of examples. In mathematical skills questions candidates need to show workings. If an incorrect response is given but the method is correct, candidates can gain access to some marks.

Many of the questions within the paper are based on consumer products made from multiple materials or multiple parts. Candidates are expected to analyse the product and refer to it in context to support their responses.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• related responses to the products or context of the product • showed clear workings in maths questions • used examples and evaluation to support extended responses • included quality control checks and detail of tooling in the manufacture/process question and covered the process fully.	• gave generic responses that did not relate to the product or its context • focused on one or two aspects in extended responses rather than appreciating the complexity of the topic • gave little support with examples in extended responses • focused on one aspect of manufacture in the process question and gave little detail of specific tools, machinery, or quality control • responded to the manufacture questions with a process that was inappropriate for the material or level of production.

Question 1 (a)

1 A controller is a handheld input device used with video games on a computer or console.

Fig. 1.1 shows a controller with push and toggle buttons.

Fig. 1.2 shows a controller in use and from different viewpoints.

Fig. 1.1

Fig. 1.2

(a) Explain **two** ways in which anthropometric data has been used in the design of the controller.

1 .....

.....

.....

2 .....

.....

.....

[4]

This question required candidates to explain how specific anthropometric data or percentiles could be used to determine the size/design of layout buttons on the controller. Reference to the controller/users was needed to achieve full marks. Many candidates identified an example of anthropometric data, e.g. thumb size and went on to explain how this was used to determine the size or proximity of the buttons or toggles. A number of candidates explained how the controller was ergonomic without referring to specific anthropometric data.

Exemplar 1

1 The 50th percentile for thumb length or thumb reach may have been used to ensure the toggle buttons are in a place where the user can comfortably reach and move them.

2 Palm length and width may have been used to ensure thickness and shape of the handles are appropriate. The 50th percentile will ensure most users can comfortably grip the handles with freedom of movements to reach buttons and toggles. [4]

In this response the candidate shows clear understanding of percentiles and identifies specific human sizes and relates this to the proximity of the buttons.

Question 1 (b)

(b) Identify **two** ways in which the design of the controller is inclusive.

Justify **each** of your answers.

1 .....

.....

.....

2 .....

.....

.....

[4]

A range of good responses were seen here demonstrating a good understanding of inclusive design, with a number of responses relating to those with limited grip/arthritis, left and right handers, partial or limited sight, colour blindness, language barriers, SEN needs and gender. There were some responses that focused on how the controller had good ergonomics for all users rather than how the design is inclusive.

Exemplar 2

1 The controller can be used for left & right handed users as it has toggles on both sides

2 The controller uses shapes on the push buttons to help with identification for possible users with visual impairment

[4]

This response gives two clear ways in which the controller is designed to be inclusive firstly for left and right handers and secondly for those with visual impairments.

Assessment for learning

Practise identifying and explaining how designers have used anthropometric data to determine the size and design of a product, how a product is ergonomic and how the design of a product is inclusive or can be designed to be more inclusive. Highlight the differences between these key concepts.

Question 1 (c) (i)

(c) A new design for a controller is being launched.

(i) Identify and describe **two** methods companies use to predict future trends.

1 .....

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.....

2 .....

.....

.....

[4]

In this question there were many appropriate methods given, e.g. the use of trend or fashion forecasters, looking at social media to see what is trending and past trends. Discussions/surveys/interviews with focus groups about what features they would like and what they have been buying were also successful responses.

Question 1 (c) (ii)

(ii) Describe how the design of products, like the controller, are influenced by brand identity.

Use specific product examples in your answer.

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.....

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.....

..... **[4]**

Candidates showed an understanding of brand identity and customer loyalty and how logos and product shape can also reflect the brand identity and a company's core principles. Some good examples were how Nike's swoosh suggests motion and movement or Apple's sleek, cutting-edge, and creative image is portrayed through designs and its logo. Some candidates focused on controllers only and these were less successful responses.

Question 1 (c) (iii)

(iii) Discuss the importance of using a marketing strategy when launching new products such as the controller.

.....

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..... **[6]**

Most candidates showed some understanding of how successful marketing strategies can make or break a product when it's launched, and how imaginative marketing can capture interest and create longevity in a product and can influence buyers' decisions. Many made links to marketing lifecycles – launch, demand, maturity and decline, and planned marketing for this. Higher level responses used examples of specific techniques or marketing strategies to support their discussion.

Question 1 (d) (i)

(d) **Fig. 1.3** shows the design of the controller buttons in a circular array.

Fig. 1.4 shows how the designer has mapped out one of the buttons onto a grid.

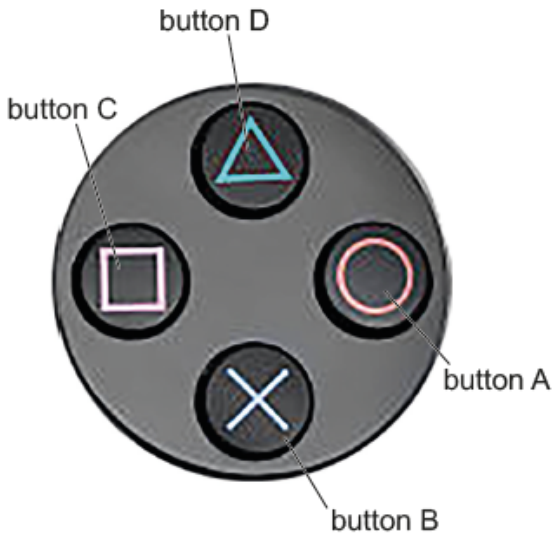


Fig. 1.3

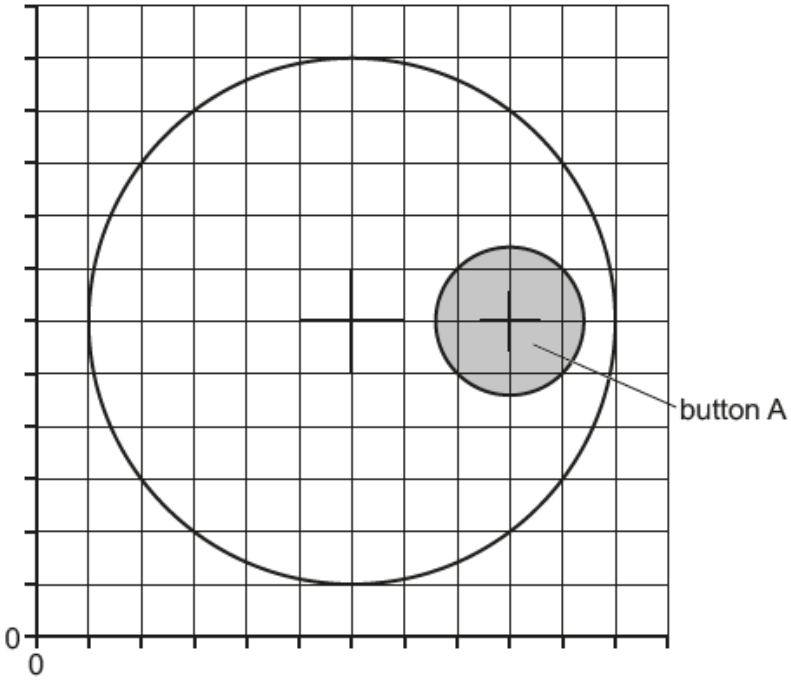


Fig. 1.4

(i) Plot buttons B, C and D onto the grid to complete the circular array. **[3]**

Question 1 (d) (ii)

(ii) Use the grid to state the coordinates for the centre point of buttons A, B, C and D. **[3]**

Button A centre point = (,)

Button B centre point = (,)

Button C centre point = (,)

Button D centre point = (,)

The majority of candidates were able to correctly plot the three points. For plotting and drawing questions the need to be accurate is important, and candidates should be reminded to have sharp pencils and draw with precision to achieve full marks. Most candidates correctly stated the grid coordinates.

Question 2 (a) and (b)

2 An electric iron is used to smooth creases in clothes using a hot plate.

These are images of an electric iron.

(a) Identify a suitable thermopolymer for the body of the iron.

..... **[1]**

(b) Identify a suitable method of commercial manufacture for the body of the iron.

Justify your answer.

.....

.....

.....

..... **[2]**

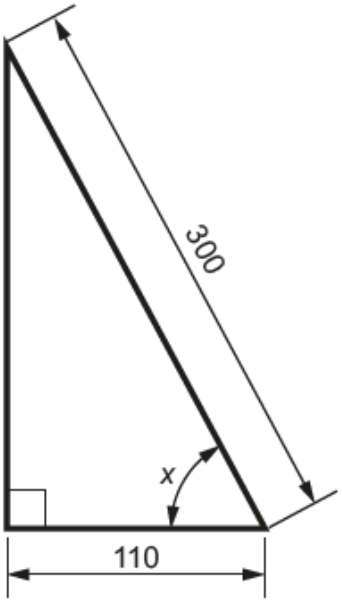
This question required candidates to identify a suitable specific thermopolymer for the casing of the iron and then to identify a suitable method of commercial manufacture. Most candidates were able to suggest a suitable thermopolymer and identify injection moulding as a suitable method of commercial manufacture, and support this with reference to the scale of production or the complexity of the mouldings.

A significant number of candidates misread this question and gave reasons the thermoploymer was suitable for the body of the iron.

Question 2 (c)

These images show the angle of the plate when the electric iron is safely stood up on a flat surface.

All measurements are given in mm.



(not to scale)

(c) Calculate angle *x*. Give your answer to the nearest degree and show your working. **[5]**

x ..... °

Most candidates identified and used the correct trigonometry formula, i.e., using inverse of Cos because the requirement is to calculate the angle. It is important to show workings as marks can be given for working out even if a final answer is incorrect.

Question 2 (d) (i) and (ii)

(d) A shop buys 240 electric irons for £10.00 each.

The shop sells 90% of these irons for £24.99 each. **The remaining irons are not sold.**

(i) Calculate the total profit that the shop would make from the sale of the electric irons. Give your answer in £ and show your working.

You **must** take into account the initial stock that was purchased. **[4]**

Total profit £ .....

(ii) Use your answer to **part (d)(i)** to calculate the overall percentage profit that would be made. **[1]**

Overall percentage profit ..... %

Many candidates calculated the overall percentage profit correctly as 124.91%. However a significant number divided the 2997.84 by the total value of sales rather than the total spent on stock and gained no marks.

Question 3 (a)

3 Developments in design practice and thinking have been influenced by the consideration of a wide range of factors.

(a) Identify and explain **two** effects of using depleting raw materials in design.

1 .....

.....

.....

2 .....

.....

.....

[4]

This question was answered well with many candidates identifying that costs would increase as the material is harder to obtain, e.g. lithium or oil or that it could put off some consumers looking for more environmentally conscious materials or brands.

Some candidates misinterpreted the question focusing on the issues associated with extracting raw materials in general rather than depleting materials.

Question 3 (b)*

(b)* Discuss the implications and opportunities of considering planned obsolescence when designing products.

Use specific examples of products in your answer. **[8]**

This question required discussion about both the implications and opportunities of considering planned obsolescence in the design of products. Many responses focused on one aspect of the question rather than both implications and opportunities, e.g. products when thrown away often end up in landfill, difficulties repairing products or how companies can maintain consumer interest in a product as they are looking to upgrade. More successful candidates referred to subscription models and upgrades with older models returned (circular economy approach) and used specific examples of products and companies to support their points.

Question 4 (a) (i) and (ii)

4 **Fig. 4.1** shows a basketball hoop in use.

Fig. 4.2 shows a diagram of the basketball hoop key dimensions. All dimensions are given in mm.

Fig. 4.3 shows the components of the basketball hoop which include:

- the ring
- bracket part A which attaches to the ring
- bracket part B which houses a mechanism
- bracket part C that is used to attach the bracket to the wall.

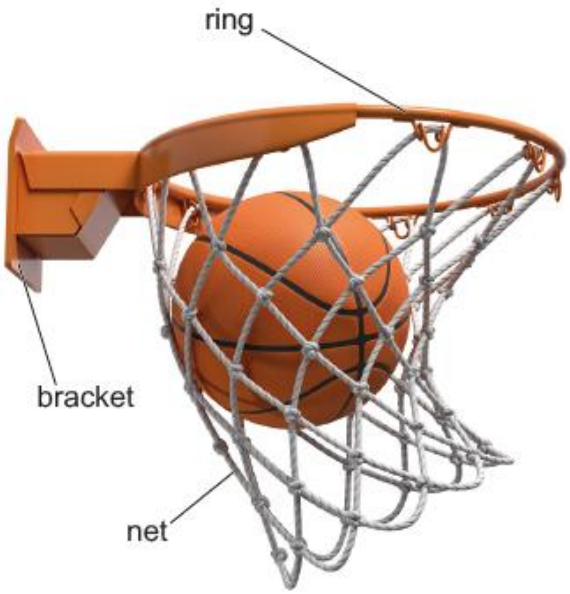


Fig. 4.1

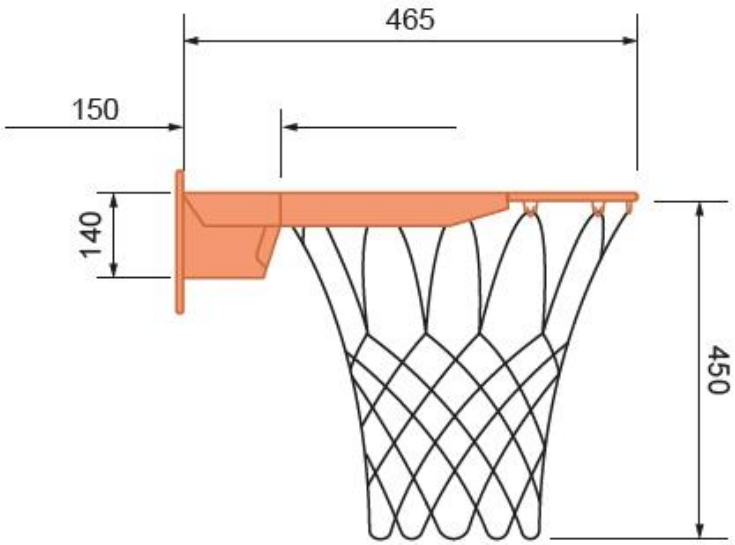


Fig. 4.2
(not to scale)

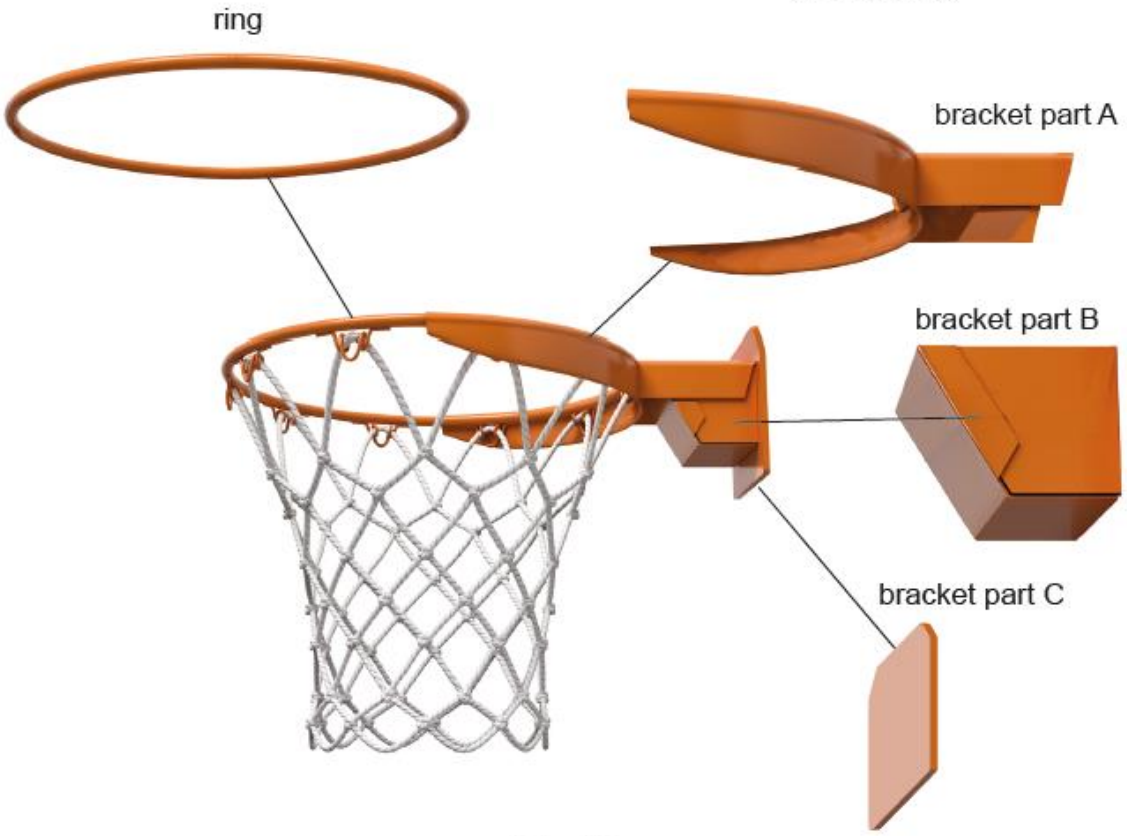


Fig. 4.3

(a) (i) Identify a suitable ferrous metal for the ring.

..... **[1]**

(ii) Explain why a ferrous metal has been used.

.....

.....

.....

..... **[2]**

This question required candidates to analyse the basketball ring in fig 4.1, 4.2 and 4.3, to identify a suitable ferrous metal for the ring and then to explain why a ferrous metal was used. Most candidates were able to name a ferrous metal and to give reasons relating to the material properties and its use in the basketball ring.

Question 4 (b) (i) and (ii)

(b) (i) Identify a suitable synthetic fibre for the net.

..... **[1]**

(ii) Explain why a synthetic fibre has been used.

.....

.....

.....

..... **[2]**

This question required candidates to analyse the basketball ring in fig 4.1, 4.2 and 4.3, to identify a suitable synthetic fibre for the net and then to explain why a synthetic material was used. Most candidates were able to name a suitable synthetic fibre and to give reasons relating to material properties and the material use in the basketball net.

Question 4 (c)

(c) Identify and explain **two** ways in which the design of the basketball hoop could be optimised.

1 .....

.....

.....

2 .....

.....

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[4]

There were some good responses to this question referring to the use of standardised parts, material quantity, size, wall thickness, and reducing the number of parts to reduce manufacturing stages. Some responses also referred to the use of software such as FEA (finite element analysis) or using structural methods such as algorithms to remove materials without compromising strength.

There was some misunderstanding of optimisation, so some candidates just talked about making the design easier to manufacture or making it easier for basketball players to use, rather than optimising the design of the product.

Assessment for learning

Design optimisation was a new term on this A Level specification first tested in 2019 and it is expected in candidates' NEA that they present 'modification and consideration of clearly defined design optimisation' of their idea. Design optimisation should be taught to support this.

Although candidates may not have access to FEA CAD software, learning about how this is used and generative design tools can help them understand the concept of optimisation. Autodesk have several free videos to help explain this concept.

Question 4 (d) (i)

(d) The ring and bracket components shown in **Fig. 4.3** are manufactured as a batch of 1000 from metal.

(i) Use annotated sketches and/or notes to show how the **ring** could be manufactured.

Identify any relevant specialist tooling and quality control checks. **[5]**

Most candidates identified that the ring is simple, and the most suitable methods for manufacture as a batch of 1000 involve continuous casting of the bar, use of bending jigs, rollers or forging. Sand casting was also appropriate if the candidate assumed the bar was solid. For a batch of 1000 and a product this simple that is large in size, die casting is not an appropriate method. Candidates should be encouraged to extend responses beyond a textbook idea and relate to the specific product, including technical terms and details, any relevant specialist tooling, and quality control checks to be successful in manufacturing process questions.

Question 4 (d) (ii)

(ii) Use annotated sketches and/or notes to show how the **bracket** shown in **Fig. 4.3**, comprising of part A, part B and part C, could be manufactured and attached to the ring.

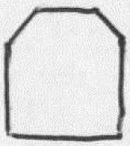
Identify any relevant specialist tooling and quality control checks. **[8]**

Most candidates identified that the parts are simple and the most suitable methods for manufacture as a batch of 1000 is sheet metal fabrication, stamping/blanking, forging, bending or press forming, then welding to join. The use of technical terms and any relevant specialist tooling and quality control checks are needed for the top of Level 3. Suitable quality control checks included tensile or impact testing, visual inspection, checking of stamped and press formed parts for dimensional accuracy, and testing of welded joints that might include use of ultra-sonic or visual inspection.

Some candidates focused on one part listed and marks were limited as details of all parts were required. Candidates should be encouraged to extend responses beyond a textbook answer and relate to the specific parts A, B and C to score highly in manufacturing process questions.

Exemplar 3

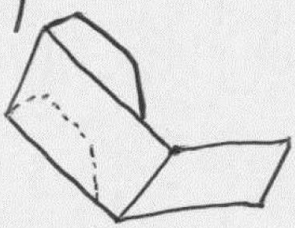
BRACKET PART C



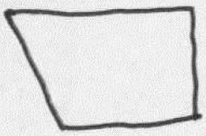
can be cut from sheet stock form of steel with a plasma cutter

BRACKET PART B

(1)



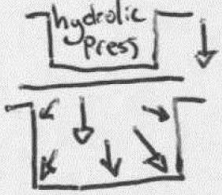
(2)



×2

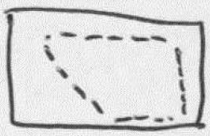
(1)+(2) are welded together and to part C

This will also be made by a steel sheet. comprised of 2 components (1)+(2). componet (1) will be made using a hydrolic press that will stamp the sheet metal into the jig.



jig

component (2) will be cut using a plasma cutter



twice for each part B.

BRACKET PART ~~B~~ A

will also be made from steel sheet metal and in two components

(3)+(4)

This response covers all parts in the question clearly with appropriate techniques and achieved a Level 3. It could be improved further with more detail of the welding process.

Question 4 (e)

(e) Identify a suitable surface finish for the ring and bracket components.

Justify why this surface finish would be used.

.....

.....

.....

.....

.....

..... **[3]**

This question required candidates to identify an appropriate surface finish and justify why it would be used. Many were able to do this relating to the protection of material for its use outdoors or application of colour to enhance aesthetics. A number of candidates misread the question and explained the application of the finish.

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