ENGINEERING DESIGN

INCLUDED ON THE KS4 PERFORMANCE TABLES

*Exemplar candidate work*

**OCR Level 1/Level 2**

**Cambridge National in**

# Engineering Design

**J822**

For first teaching in 2022 | Version 1

## Unit R038: Principles of engineering design

## Summer 2024 series

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# Contents

# Introduction

These candidate exemplars have been chosen from the Summer 2024 examination series.

OCR is open to a wide variety of approaches and all responses are considered on their merits. These exemplars should not be seen as the only way to answer questions; they have been chosen because they show how the mark scheme has been applied.

Please always refer to the specification for full details of the assessment for this qualification. You may find it useful to read these exemplar responses alongside the appropriate assessment materials (for example question paper, mark scheme and examiners'/moderators' report).

It is important to note that approaches to question setting and marking will remain consistent. At the same time, we review all our qualifications annually and may make small adjustments to improve the performance of our assessments. We will let you know of any substantive changes.

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# Question 12 (b) (i) – Short answers

**(b)**

**(i)** Explain **one** thing that engineers must consider when they select materials for manufacturing a product.

.....

.....

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

## Exemplar 1

2 marks

Engineers must consider how strong it is to ensure it will be suitable for the product being made. This might be if it can withstand the weight of a person for e.g. [2]

Explain or describe how something might occur or describe how a particular circumstance will be affected or impacted by a situation for 2 marks are common question styles.

This question specifically asks for one thing that engineers must consider, with a mark being awarded for an appropriate answer. The candidate states the material must be strong and then justifies their answer by explaining that the material might have to withstand the weight of an adult. This justification is awarded the second mark and therefore it is a full mark response.

## Exemplar 2

2 marks

Environmental effect - the engineers must decide if using a certain material is environmentally sustainable, and if not see how to change it out [2]

This question specifically asks for one thing that engineers must consider, with a mark being awarded for an appropriate answer. The candidate states that engineers must consider the environmental impact and then justifies their answer by explaining that using a certain material must be environmentally sustainable and if not it should be changed. This justification is awarded the second mark and therefore it is a full mark response.

**General commentary**

Candidates should be able to justify their responses to demonstrate knowledge and understanding. Candidates often lose marks through either not justifying an answer or giving two things to consider when only one is required, rather than justifying.

# Question 13 (a) (i) – Engineering drawing

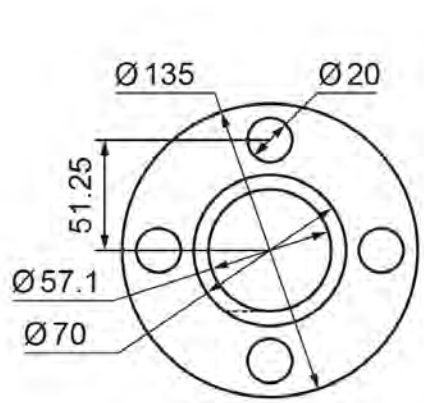
**13** This is an aluminium flange spacer for mounting a motor.

**(a)**
**(i)** In the space below, complete the third angle orthographic drawing by adding the **top view** of the spacer, using the correct drawing conventions.

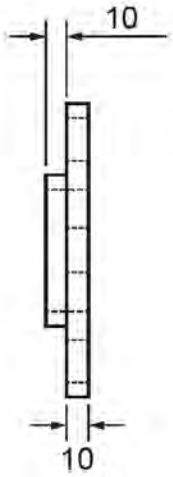
Your drawing does **not** have to be drawn to scale.

You do **not** have to add measurements.

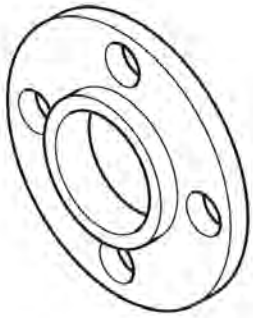
**Top view**




**Front view**




**Right view**

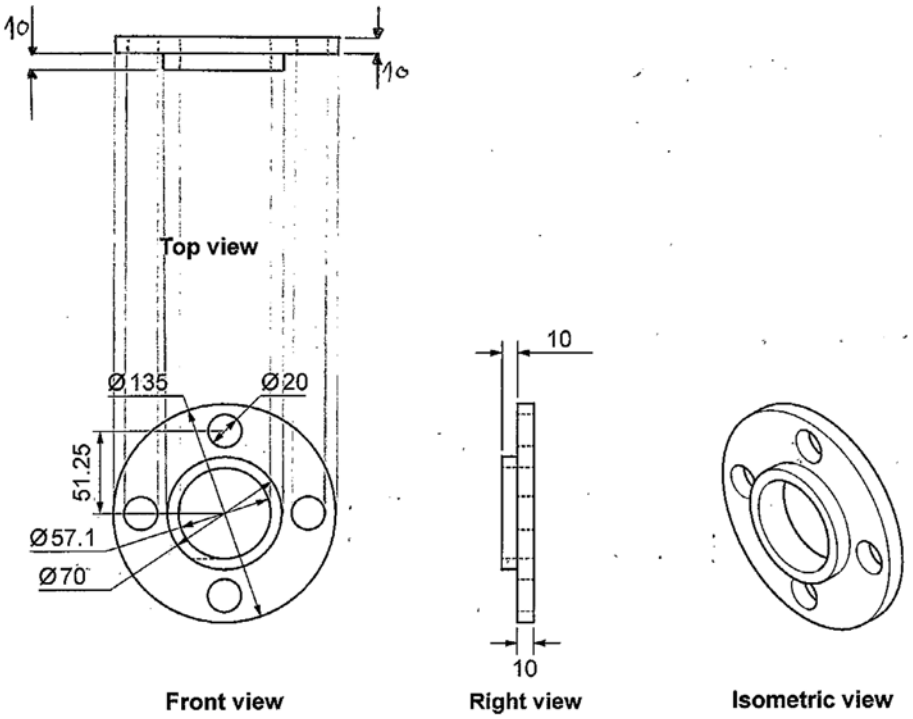


**Isometric view**

**[3]**

## Exemplar 1

3 marks



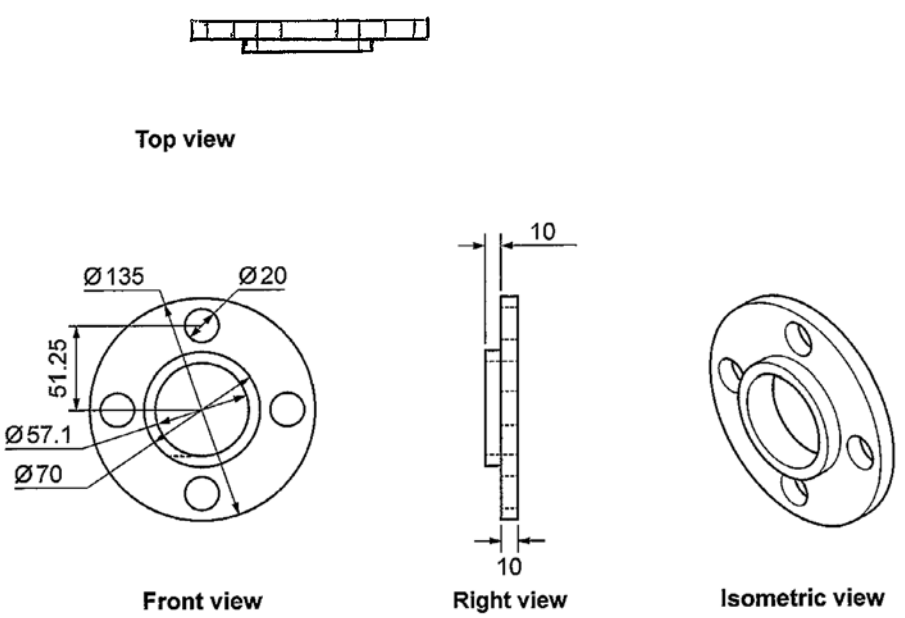

The candidate correctly completes the third angle orthographic drawing by adding in the top view.

Marks were awarded for: the correct shape (1), correct hole convention, all holes shown via hidden detail, which should be dashed lines (1) and the correct orientation of the flange, in other words the correct way up (1).

In this example the candidate has aligned the top view correctly and whilst this wasn't awarded a mark specifically it has helped the candidate as they have projected the detail and consequently not missed any aspect out.

## Exemplar 2

2 marks




The candidate completes the third angle orthographic drawing by adding in the top view.

Marks were awarded for: the correct shape (1), and the correct orientation of the flange, in other words the correct way up (1).

The candidate did not show the correct hole convention, as all holes should be shown via hidden detail, which should be dashed lines, unfortunately they have used solid lines which is incorrect.

### General commentary

Question 13 (a) (i) required candidates to demonstrate knowledge and understanding by interpreting the given drawing or information in the space provided using correct drawing conventions.

Candidates being able to demonstrate a good understanding of engineering drawing conventions and principles and then being able to apply them to a given scenario is very important within this specification.

# Question 14 (b)

**(b)** Use an example to explain why design features might be changed to improve a design.

.....

.....

.....

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

## Exemplar 1 3 marks

Xbox and PS4, the standard PS4 joysticks are located in the centre of the controller  whereas Xbox took a more ergonomically friendly approach altering the joystick positions 
(design features may change ~~due~~ to save resources / lower costs too) **[3]**

### Commentary

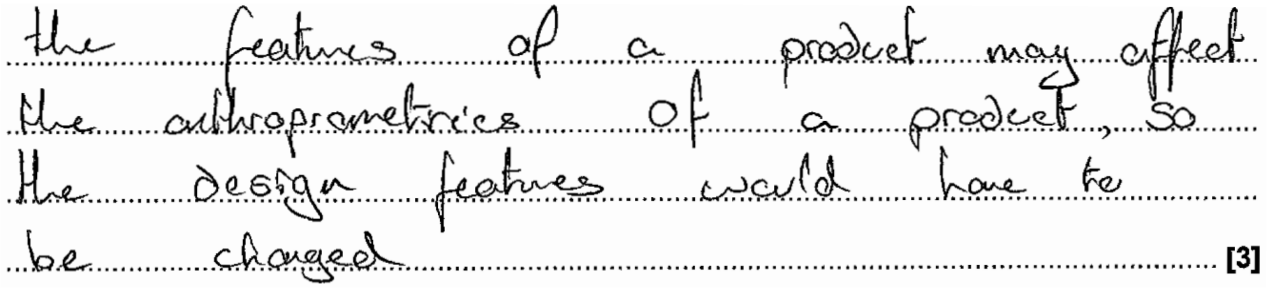
The candidate immediately states the Xbox and PS4 as a combined example and then explains clearly where the joysticks are placed and why the Xbox took a more ergonomically friendly approach with the joystick positioning.

Marks were awarded in the following way:

- 1 mark for an example or for a specific product example, or scenario.
- 1 mark for why the change is made.
- 1 mark for the impact of the change, or justification.

Use of technical language is also helpful and supports full marks as knowledge is clearly demonstrated.

## Exemplar 2 1 mark


the features of a product may affect the anthropometrics of a product, so the design features would have to be changed [3]

### Commentary

This style of question is also common within this specification; it is seeking an example to support the explanation of a given design engineering scenario.

The candidate correctly gives anthropometrics as a design feature that might be changed to improve a design but then does not build on the example by explaining why changes might be needed and the impact of the change. No rewardable justification is present.

Marks were awarded in the following way:

- 1 mark for an example or for a specific product example, or scenario.

| General commentary |
| --- |
| This style of question is also common within this specification in seeking an example to support the explanation of a given design engineering scenario. |

# Question 14 (c) – Long answer

**(c)** Discuss the advantages and limitations of carrying out **user testing** as early as possible in the design process to evaluate design ideas.

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.....

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

## Exemplar 1 5 marks

Some advantages of user testing early are; being able to visualise key flaws in a products design, User wants in a product and anthropometric data from useage. These would be key to improving the design of a product before too ~~muc~~ many resorces are spent developing a worse quality design. On the other hand, early testing might not reflect what final testing ~~with~~ would show. For example, user testing early with a prototype might not clearly inform engineers as the model used might not be fully refined. **[6]**

## Commentary

The candidate has clearly stated several advantages that user testing early in the design process brings to evaluating design ideas. Key flaws, user wants, and anthropometric data are three very good technically correct examples of information that could be garnered and then used to improve the design before too many resources are spent developing the design further.

They then turn their attention to limitations making the point that user testing early using a prototype might not clearly inform engineers as the model might not be fully refined.

Both sides of the discussion demonstrate thorough understanding and consistent use of appropriate terminology to demonstrate their knowledge.

The response clearly fits the Level 3 marking criteria below and with a little more detail within the limitations aspect of the question would have been full marks.

This is a discuss question and both the only levels response marked question and the highest tariff with 6 marks available within the paper.

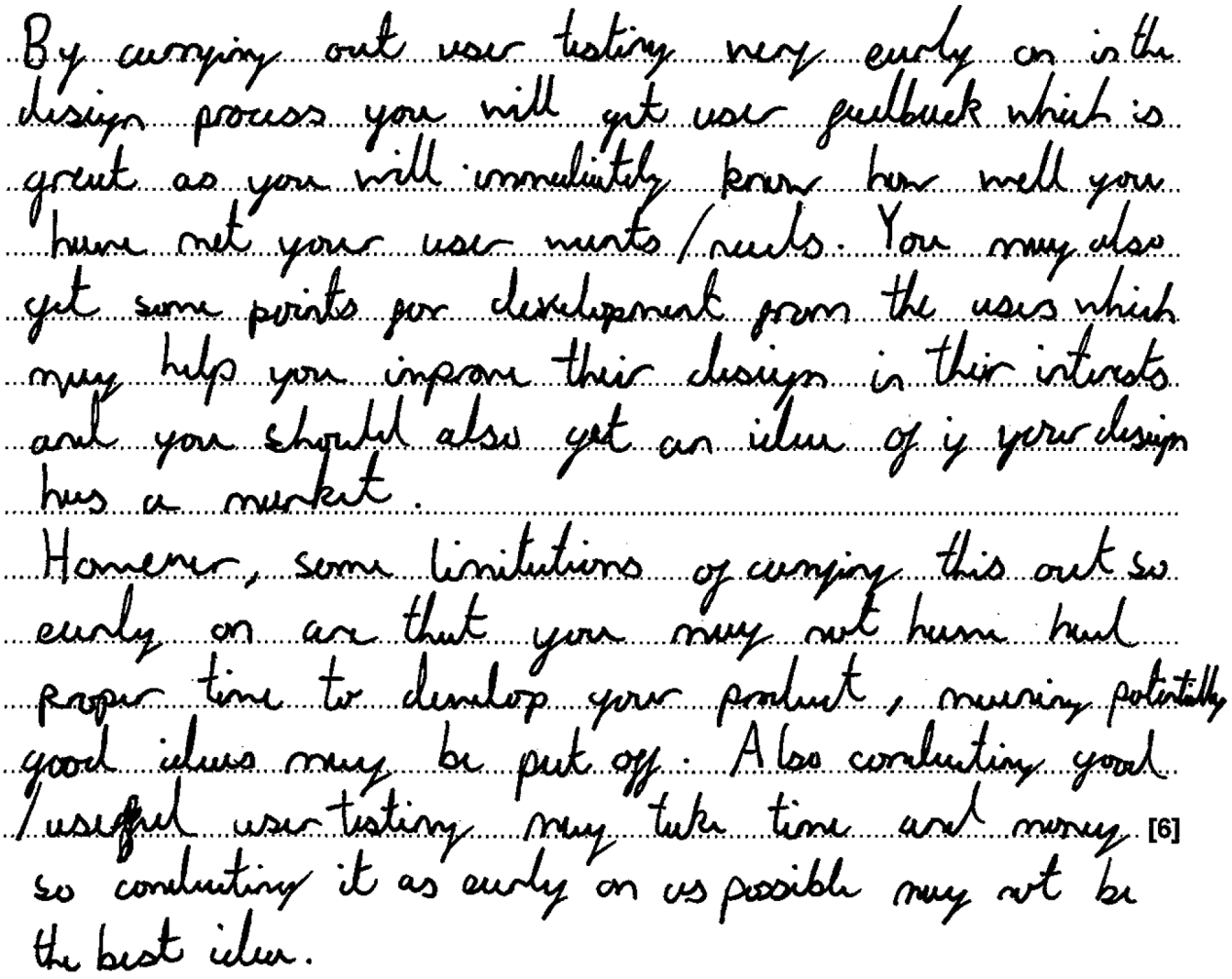
It is expected that candidates will approach the question from more than one point of view and be able to expand their thoughts and opinions with reasoning, related impacts and justification. Higher marks are awarded for answers that include a reasoned discussion/debate with appropriate use of terminology.

The question seeks both advantages and limitations of carrying out user testing and consequently both aspects of the question would be expected to be covered to access higher marks.

**Level 3 (5–6 marks)**

A **thorough** discussion of the advantages and limitations of carrying out user testing as early as possible, showing understanding of all the points stated. **Consistent** use of appropriate terminology. Typically, two or more points made with advantages AND limitations fully discussed.

## Exemplar 2 1 mark


By carrying out user testing very early on in the design process you will get user feedback which is great as you will immediately know how well you have met your user wants / needs. You may also get some points for development from the users which may help you improve their design in their interests and you should also get an idea of if your design has a market.

However, some limitations of carrying this out so early on are that you may not have had proper time to develop your product, meaning potentially good ideas may be put off. Also conducting good / useful user testing may take time and money so conducting it as early on as possible may not be the best idea. **[6]**

### Commentary

The candidate clearly begins their discussion explaining that there is the opportunity to gain user feedback to establish immediately whether user wants/needs have been met. They also explain how development points which may help improve the design as well as having an idea whether the design has a market.

Limitations then explain how carrying out testing early might not allow for time for full development of the product, putting off some potentially good ideas. They then explain that useful user testing does take time and money so conducting early may not be the best idea.

Both sides of the discussion demonstrate thorough understanding and consistent use of appropriate terminology to demonstrate their knowledge.

The response clearly fits the Level 3 marking criteria below.

**Level 3 (5–6 marks)**

A **thorough** discussion of the advantages and limitations of carrying out user testing as early as possible, showing understanding of all the points stated. **Consistent** use of appropriate terminology. Typically, two or more points made with advantages AND limitations fully discussed.

# Question 16 (b) (ii) – Evaluate

**(ii)** Anthropometric data gives measurements of the human body.

Evaluate the benefits of using anthropometric data when designing gym equipment.

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

## Exemplar 1 4 marks

Using Anthropometric data is essential for things like gym equipment. It allows you to create the product ergonomically and safely so it can be used effectively. It also allows for a more inclusive design, as someone with small hands may not be able to grip a dumbell the same as someone with big hands **[4]**

### Commentary

This exemplar immediately states that the approach allows the creation of an ergonomic and safe product which can then be used effectively. The candidate gives examples and states what the outcome will be, in terms of effective usage.

They go on to explain clearly that it allows for a more inclusive design with a further example of hand size being used to demonstrate their knowledge of what the use of anthropometric data does in benefiting the design of gym equipment, specifically a dumbbell.

A coherent answer with an example scenario given with clear understanding of how anthropometric data can be used demonstrated. Specific examples are then given to help justify the impact of using the data.

Evaluate questions, in this instance worth 4 marks, require candidates to consider benefits and or drawbacks of a given approach to design.

In this question, candidates are asked to evaluate the benefits of using anthropometric data when designing gym equipment. The response clearly fits the marking criteria below:

- An example of how the anthropometric data is used e.g. data is used to determine seat height,
- How this benefits the user or manufacturer
- Justification/impact of the benefit.

## Exemplar 2

1 mark

The equipment will be better designed for intended users. Furthermore, barbells and dumbells bar te grip will be better shaped, improving user expeiance

..... [4]

### Commentary

This response gives a very straightforward explanation of how the anthropometric data benefits the designing of gym equipment in terms of the intended users with barbells and dumbbells given as examples with the impact on a better shaped product therefore improving user experience.

A coherent answer with an example scenario given to explain the benefits with the impact also highlighted. Further technical detail or examples of how the data might be used within the designing would be required to attain full marks.

Mark scheme criteria below:

- An example of how the anthropometric data is used e.g. data is used to determine seat height,
- How this benefits the user or manufacturer
- Justification / impact of the benefit.

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