

INCLUDED ON THE
KS4 PERFORMANCE TABLES

Teacher guide

OCR Level 1/Level 2

Cambridge National in
Engineering Design

J822

For first teaching in 2022 | Version 1

**Exploring our exams: a guide to our Sample Assessment
Material**

ocr.org.uk/cambridgenationals

Introduction

This is Sample Assessment Material (SAM) which has been produced for the qualification OCR Level 1/Level 2 Cambridge National in Engineering Design.

The SAM is an example exam paper that we publish alongside a new specification to help illustrate its intended style and structure when a qualification is first launched. We wanted to share the story of our assessment approach with you so when you look through the paper you will find we have pointed out certain features and explained the decisions we have made.

Resources to help support in teaching different areas of content can be found on the Cambridge National in Engineering Design webpage under '[Planning and teaching](#)'.

Our exam papers are developed with our accessibility principles in mind. The document [Understanding the Assessment: examined and moderated](#) tells you a little more about the principles and rationale underpinning our approach for the qualifications. The 'Command Words' are in both [Understanding the assessment: examined and moderated](#) and the [specification](#). These tell you what we mean by each command word and how students should approach the question and understand its demand.

You said, we did

During the development of this qualification, **we talked extensively with teachers, subject experts** and our senior assessment teams to influence its structure, content and assessment materials. We then shared our final materials to make sure that they met the identified needs.

You told us that you wanted **to keep the exam as close to the current exam** for the existing Cambridge National in Engineering Design, so that's what we have tried to do, by retaining the tone and feel.

You told us that **you would like the exam to start with multiple choice questions** to help students settle, so that's why Section A is made up of multiple choice questions.

You told us that you wanted **the exam to be as short as possible** to keep students focused, so we have used the principle of a mark per minute.



Sample Assessment Material (SAM)

All students will sit the exam at the same time on the same day.

...day ... Month Year – Morning/Afternoon

OCR Level 1/Level 2 Cambridge Nationals in Engineering Design

R038: Principles of engineering design

The time allowed is designed to give students approximately one minute per mark.

Time allowed: 1 hour 15 minutes

Students can use a calculator in this exam if needed.

You must have:

- a ruler

You can use:

- a calculator



Write clearly in black ink. **Do not write in the barcodes.**

Centre number

--	--	--	--	--	--

Candidate number

--	--	--	--	--	--

First name(s) _____

Last name _____

INSTRUCTIONS

- Use black ink.
- Write your answer to each question in the space provided. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question numbers.
- Answer **all** the questions.

INFORMATION

- The total mark for this paper is **70**.
- The marks for each question are shown in brackets [].
- Dimensions are in millimeters unless the question says something different.
- This document has **20** pages.

ADVICE

- Read each question carefully before you start your answer.

This exam will always be set and marked by us. Exams will be available in January and June each year. The exam must be taken as terminal assessment. This means that the result from the exam taken in the final assessment series before certification will be the one that counts towards the student's overall grade.

If students require additional answer space, lined pages may be available at the end of the answer booklet in a live question paper. Remember the question number(s) must be clearly shown.

The exam will always have 70 marks. Section A will have 10 marks and Section B will have 60 marks.

Section A

Students should use a tick (✓) in the box to show their response to MCQs.

Put a tick (✓) in the box next to the **one** correct answer for each question.

1 On an engineering drawing what is represented by the line in **Fig. 1**?



Fig. 1

- (a) Centre line
- (b) Hidden detail
- (c) Leader line
- (d) Projection

[1]

2 Which product would typically use 'one-off' as a scale of production?

- (a) Car
- (b) Road bridge
- (c) Shampoo bottle
- (d) Smart phone

[1]

Section A has 10 compulsory multiple choice questions (MCQs).

Each question in this section is worth one mark. MCQs will test a range of knowledge from across the unit content.

3 Which type of drawing is shown in **Fig. 2**?

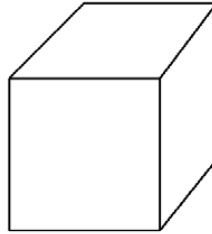


Fig. 2

- (a) Assembly
- (b) Isometric
- (c) Oblique
- (d) Orthographic

[1]

4 Which of these is an example of inclusive design?

- (a) Including a wind-up charger on a radio
- (b) Producing a computer-gaming chair in multiple colours
- (c) Providing a ramp for wheelchair access to a building
- (d) Putting a company logo on a remote control

[1]

5 Which of these statements best describe planned obsolescence?

- (a) A product created to last indefinitely
- (b) A product that can be repaired
- (c) A product that is created to last a limited time
- (d) A product that is recyclable

[1]

Turn over

MCQs will always have four response options listed in alphabetical or numerical order. The four response options will consist of the correct answer and three distractors.

4

- 6 On an engineering drawing which of the following mechanical features is shown in Fig. 3?

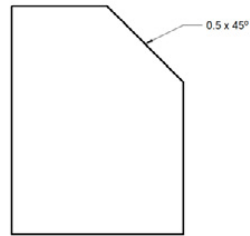


Fig. 3

- (a) Chamfer
- (b) Countersink
- (c) Hole
- (d) Thread

[1]

- 7 Which of these modelling methods is typically used for electronic circuits?

- (a) Block
- (b) Breadboarding
- (c) Card
- (d) 3D printing

[1]

The number of marks assigned to a question will always be given at the end of the question and will always be right aligned.

Where appropriate we will embolden key information in a question to make it clearer.

8 What does the letter **M** mean in the product analysis tool ACCESS FM?

- (a) Materials
- (b) Mechanical
- (c) Modelling
- (d) Motor

[1]

9 Which **type** of manufacturing process involves removing material by machining to create a product?

- (a) Assembly
- (b) Finishing
- (c) Shaping
- (d) Wasting

[1]

10 A dimension is $10 \pm 0.2\text{mm}$. Which of these would be within tolerance?

- (a) 9.8mm
- (b) 10.3mm
- (c) 10.4mm
- (d) 9.5mm

[1]

Turn over

Section B

11 (a) A design brief sets out what is required by a user. State **two** types of information that may be included in a design brief.

1

2

[2]

(b) State **two** aesthetic factors that can influence a user's opinion of a product.

1

2

[2]

(c) State the meaning of 'market pull'.

.....

.....

[1]

(d) Explain **one** way in which ergonomic design could improve the use of a computer mouse.

.....

.....

.....

.....[2]

Section B contains a number of mandatory questions that are divided into sub-questions. Question types include:

- short answer
- closed response
- shorter response in context
- extended response

These allow us to assess the following Performance Objectives:

- PO1 – Recall knowledge and show understanding
- PO2 – Apply knowledge and understanding
- PO3 – Analyse and evaluate knowledge, understanding and performance

Sub-content topic areas will be sampled across exam papers, over time.

The number of answers needed will always be written as a word in bold.

Short and medium answer responses test knowledge and understanding from across the unit content and allow students the opportunity to give free responses.

(e) Fig. 4 shows the initial stages of a linear design process. Complete the flowchart by inserting the missing stages.

Missing stages:	Test prototype
	Production plan
	Generate ideas
	Research the problem

When we ask students to complete a diagram or process, we will give a list of words for the student to choose from. Students choose their answer and write it in the space given.

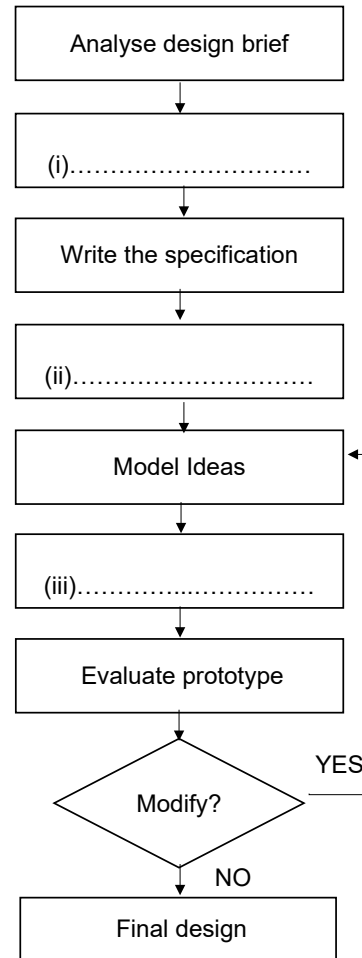


Fig. 4

[3]

12 (a) State what the symbol in Fig. 5 represents in an orthographic drawing.

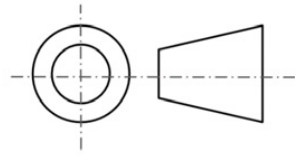


Fig. 5

.....
 [1]

(b) A component has a length of 150 mm. Complete the drawing in Fig.6, using standard conventions, placing the following items in the correct location:

- Leader lines
- Arrows
- Dimension



Fig. 6

[4]

- (c) A component has a drilled hole with a diameter of 30 mm. Show this on the drawing using standard conventions in Fig. 7.

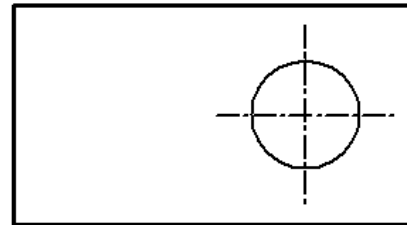


Fig. 7

[2]

- (d) State the name of each mechanical feature used in engineering drawings. Write your answer in Table 1.

Where students need to answer in a table it will be centered on the page.

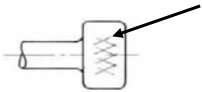
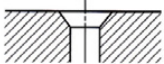
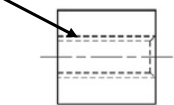
Mechanical feature	Name
(i) 	(i).....
(ii) 	(ii).....
(iii) 	(iii).....

Table 1

[3]

Turn over

- 13 **Fig. 8** shows a group of electric scooters (e-scooters). Many cities around the world provide rentable e-scooters to decrease traffic pollution. The e-scooters are made from a variety of metals and plastics, are powered by rechargeable batteries and users must be over 16 years of age.



Fig. 8

- (a) Explain how the following requirements could influence the design of an e-scooter as shown in **Fig. 8**.

(i) Aesthetics

.....

 [2]

(ii) Ergonomics

.....

 [2]

(iii) Sustainability

.....

 [2]

Where contexts are used, information will be concise and specific to the question.

- (b) An engineering design specification (EDS) for an e-scooter could contain information about the aesthetics, cost and the environment.

State **two** other items of information that would normally be given in an EDS for an e-scooter, giving a reason for each.

1

.....

.....

2

.....

.....

When a question asks for a specific number of points, we will always put numbers or response headings against the answer lines to show where students should write each point of their answer.

[4]

Turn over

14 Fig. 9 shows a 3D printing machine.



Fig. 9

(a) Describe the printing process using a 3D printer.

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.....[6]

Questions may include images to help students. Images will always be in grey scale.

The number of lines given for a question indicate the approximate length of the answer needed.

(b) Explain **one** advantage and **one** disadvantage of using 3D printers.

• Advantage

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• Disadvantage

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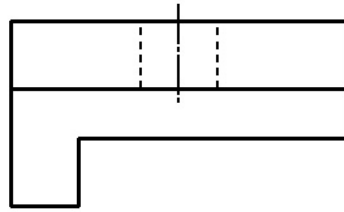
[4]

Where a question asks specifically for advantages and disadvantages to be given, we will always put headings against the answer lines to show where students should write their answer.

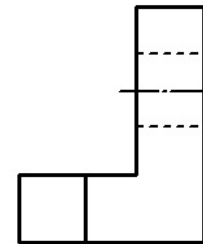
Turn over

15 (a) Fig. 10 is a drawing of a shelf bracket.

In the space provided complete the third angle orthographic projection by adding a **front view**.



PLAN VIEW



SIDE VIEW

FRONT VIEW

Fig.10

[2]

Where a question asks for the completion of a drawing, we will provide space for students to do so.

- (b)** State the meaning of the following abbreviations used on engineering drawings.

 - (i)** DIA [1]
 - (ii)** MATL..... [1]

- (c)** State **one** purpose of isometric drawings.

..... [1]

- (d)** Recycle and Repair are two of the 6Rs of sustainable design.

State **three** of the other 6Rs of sustainable design.

 - 1
 - 2
 - 3

[3]

- (e)** Give **one** reason why an engineering company might implement relevant British Standard for its products.

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.....

.....

..... [2]

Turn over

16 (a) Describe **one** method of evaluating a design idea, other than making a model.

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..... [2]

(b) Describe **one** method of measuring the linear dimensions of a completed product.

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..... [2]

(c) An engineering company is proposing to move from manually creating drawings of products to producing all drawings using CAD software.
Discuss the advantages and disadvantages of this change.

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..... [6]

Appendix B in the Specification contains a glossary of Command Words that will be used in our exams. The glossary tells you what we mean by each command word.

There will always be one extended response question that is marked by a levels of response mark scheme in Section B of the exam. This will always be a 6 mark question.

END OF QUESTION PAPER

Indicates to students there are no more questions to answer.

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