ENGINEERING DESIGN

INCLUDED ON THE KS4 PERFORMANCE TABLES

Examiners' report

OCR Level 1/Level 2

Cambridge National in

Engineering Design

J822

For first teaching in 2022 | Version 1

R038 January 2025 series

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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 Teach Cambridge.

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R038 series overview

This is only the second year for this newly reformed Level 1/Level 2 Cambridge National in Engineering Design, but we were pleased with the responses that we received from the cohort for R038. The candidates appeared to have had a relatively 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 15 minutes. The total mark for this paper is 70. The marks for each question are shown in brackets []. The question paper begins with a set of ten multiple choice questions. The question paper is designed to have a range of questions that carry a marking tariff between 1 and 6 marks. There is one extended response question, Question 14 (b), and this will be assessed via Levels of Response.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• had a broad understanding of engineering design and had a fulsome knowledge of the specification • had a good understanding of engineering drawing conventions and principles and were able to apply these accurately • were able to interpret engineering drawings • had a good understanding of a range of modelling techniques, and the benefits to the user and manufacturer • were able to give examples to given scenarios and justify their responses • were able to give answers with a justified response to demonstrate knowledge and understanding • were able to identify manufacturing processes • were able to demonstrate knowledge of product criteria and the reasons for material choice • were able to analyse given information, such as charts, graphs and tables • understood key terms including 'scale of manufacture' 'manufacturing processes' 'Capital costs' • had some understanding of how anthropometric data can be used.	• did not appear to have a broad knowledge of engineering design or the specification more generally • found engineering drawing conventions challenging • were not able to interpret engineering drawings • found justification difficult when extending a point they have made • did not have a clear understanding of terms used within manufacturing processes • did not give an example within their answer where required, to access the higher marks • did not always read some questions thoroughly before answering • struggled to identify and explain appropriate reasons for materials and manufacturing processes • did not demonstrate knowledge of identifying methods and uses of primary and secondary research.

Section A overview

Section A was generally well answered, with many candidates finding the range of questions to their liking and accessible.

Some candidates didn't attempt some of the questions in this section. Even if a candidate is unsure when attempting multiple choice questions, it is still advisable to have a go.

Candidates who are afforded extra-time or have special consideration sometimes typed out each answer in full rather than simply ticking a box. This is obviously time consuming for them and we would urge centres to encourage candidates to make use of the opportunity to access multiple choice questions on the question paper as well as utilising the opportunity to respond via typing their answers for any other questions that they wish. It is perfectly acceptable to use both modes within their answer.

Question 1

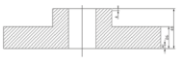
1 Which of these represents the diameter on an engineering drawing?

(a)  ☐

(b) 

☐

(c)  ☐

(d)  ☐ **[1]**

c) is the correct answer and was accessible for many candidates.

Question 2

2 Which of these examples describes an advantage of an ergonomic design?

(a) Bright colours to attract buyers ☐

(b) Textured surface for easy grip ☐

(c) Universal size so anyone can use it ☐

(d) Using sustainable materials to save finite resources ☐ **[1]**

b) is the correct answer and was accessible for many candidates.

Question 3

3 Which of these is an example of a shaping process?

(a) Adding aesthetic features to a product ☐

(b) Assembling final parts to a product ☐

(c) Cutting a thread ☐

(d) Injection moulding ☐ **[1]**

d) is the correct answer and was accessible for many candidates.

Question 4

4 Which of these is an aesthetic feature?

(a) Bluetooth connectivity ☐

(b) Carbon fibre patterned finish ☐

(c) Soft grip handle ☐

(d) Splash-proof casing ☐ **[1]**

b) is the correct answer and was accessible for many candidates.

Question 5

5 Which of these is a mechanical feature on an engineering drawing?

(a) Centre line ☐

(b) Chamfer ☐

(c) Scale ☐

(d) Tolerance ☐ **[1]**

b) Chamfer is the correct answer. Unfortunately, many students did not understand mechanical feature in this context and incorrectly gave either (a) or (c) as their answer.

Question 6

6 Which of these is an example of **capital costs** to a manufacturing business?

(a) Energy costs ☐

(b) Labour ☐

(c) Land ☐

(d) Packing materials ☐ **[1]**

c) Land is the correct answer and was accessible for some candidates, although many candidates did get confused and cited a) or b).

Misconception

Unfortunately, many students did not understand the term **capital costs** in this context and incorrectly gave either (a) or (b) as their answer.

Question 7

7 Which of these is a reason for carrying out product disassembly?

(a) Finding out the cost of components used ☐

(b) Finding out the purpose of components ☐

(c) Finding out where components were made ☐

(d) Finding out who manufactured a component ☐ **[1]**

b) is the correct answer and was accessible for many candidates.

Question 8

8 Which of these is a method of evaluating a design idea?

(a) Flowchart ☐

(b) Freehand sketching ☐

(c) Ranking matrices ☐

(d) Virtual 3D CAD modelling ☐ **[1]**

c) is the correct answer and was accessible for many candidates.

Question 9

9 Which of these is an example of **quantitative data** that could be used in Quality Function Deployment (QFD)?

(a) 75% of people surveyed prefer Android-operated electronic devices ☐

(b) Android devices are the best-selling items online ☐

(c) Android devices represent a large proportion of electronic devices available ☐

(d) Focus group members agreed they like Android-operated electronic devices most ☐ **[1]**

a) is the correct answer and was accessible for many candidates.

Question 10

10 Which of these is an example of a British Standard mark applied to products?

(a)  Copyright ☐

(b)  Kitemark ☐

(c)  Quality check ☐

(d)  WEEE ☐ **[1]**

b) is the correct answer and was accessible for many candidates.

Section B overview

This section has a range of questions styles that generally fall into the following categories:

Identify or state a specific piece of information, image or reason for 1 mark. For these questions, candidates are required to be able to demonstrate their knowledge by identifying or recognising a given item within a diagram/image, or use direct recall to answer a question, for example the definition of a term.

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

Explain, Describe, Analyse and Discuss questions test candidates' understanding in greater depth than identification or recall style. Understanding will be demonstrated through answering how, why; reasons for, advantages, considerations of something to/in different contexts. For example:

- Explain or describe how something might occur or describe how a particular circumstance will be affected or impacted by a situation for 2/3 marks. Examples are often sought in these questions with a mark being given for an appropriate example.
- Evaluate questions for 4 marks, require candidates to consider benefits and or drawbacks of a given approach to design.
- Analyse an approach or explain the advantages of a technical scenario for 3-4 marks.
- Discuss: candidates would be expected to approach from more than one point of view. A higher tariff question, with up to 6 marks available and marked via the Level of Response given within the answer. Candidates should provide more than just a series of statements and be able to expand on these with reasoning, the impact of and or justification. Higher marks are award for answers that include a reasoned discussion/debate with appropriate use of terminology.

Question 11 (a)

11 Designers need to consider a range of factors to meet the design specification.

(a) Complete the table with the missing terms.

ACCESS FM
Aesthetics
C
Customer
E
S
Safety
Function
Materials and manufacturing

[3]

Cost (1)

Environment (1)

Size (1)

A very accessible question with many candidates gaining full marks.

Question 11 (b)

(b) Explain **one** way that a designer can identify the desired functions of a new product design.

.....

.....

.....

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

Candidates found this question very challenging with very few being able to explain one way that a designer can identify the desired functions of a new product design.

Correct responses covered a variety of research methods including interviewing customers to find out what they wanted.

Question 11 (c)

(c) Identify **two** manufacturing considerations that influence the choice of materials when creating a design.

1 .....

2 .....

[2]

Candidates had for the most part understood the acronym ACCESSFM and as such gave a wide variety of responses within this understanding.

Question 11 (d)

(d) Explain why material safety is important when designing a child's toy.
Use **one** example to support your answer.

.....

.....

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.....

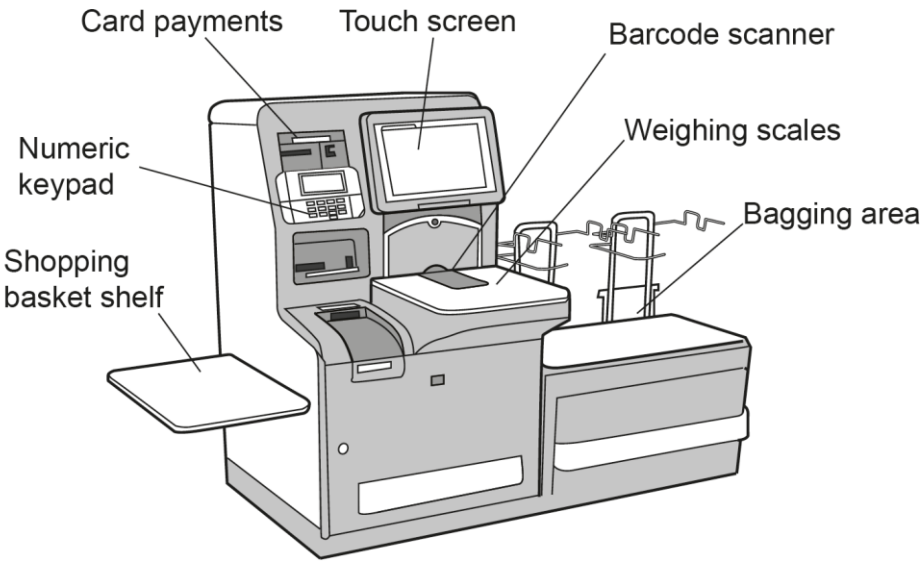
.....

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

Candidates found this question accessible and displayed good understanding of material safety being important when designing a child's toy. Many missed the 3rd mark by not giving an example or scenario.

Question 12 (a)

12 A supermarket self-checkout station is shown below.



(a) State **two** ways the design of the self-checkout station may **not** be accessible to meet the user requirements for a range of customers.

1 .....

.....

2 .....

.....

[2]

Many candidates stated that cash could not be used on the self-checkout as well as a number of different inclusivity issues also being raised, such as reaching the screen if a wheelchair user.

Question 12 (b)

(b) Describe how a designer could use a user-centred design strategy to identify appropriate features of the self-checkout station to meet user needs.

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.....

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.....

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

Many candidates explained clearly what user-centred design is but then often did not connect this knowledge to demonstrate how a designer could use it within a strategy to identify appropriate features of the self-checkout to meet user needs.

Question 12 (c)

(c) Explain **one** way anthropometric data could be used in the design of the self-checkout station.

.....

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

Those candidates that understood how anthropometric data were able to explain how it could be used in the design of the self-checkout station.

Misconception

Unfortunately, many students did not understand how **anthropometric data** could be used**,** giving numerous different interpretations of what it might be and unfortunately gained very few marks on this question.

Question 12 (d)

(d) A full-sized card mock-up is used to test the initial design of the self-checkout station.

Explain **one** benefit of using this method to test the design.

.....

.....

.....

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

Candidates are asked to explain **one** benefit, unfortunately there were many examples of candidates explaining more than one benefit and subsequently not including very much detail.

Candidates often explained that the card model being full-size will show if features are in the correct place, so when you are next to it, you can tell if you can reach it.

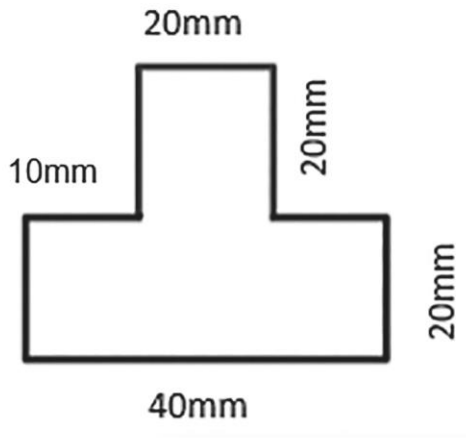
Question 13 (a) (i)

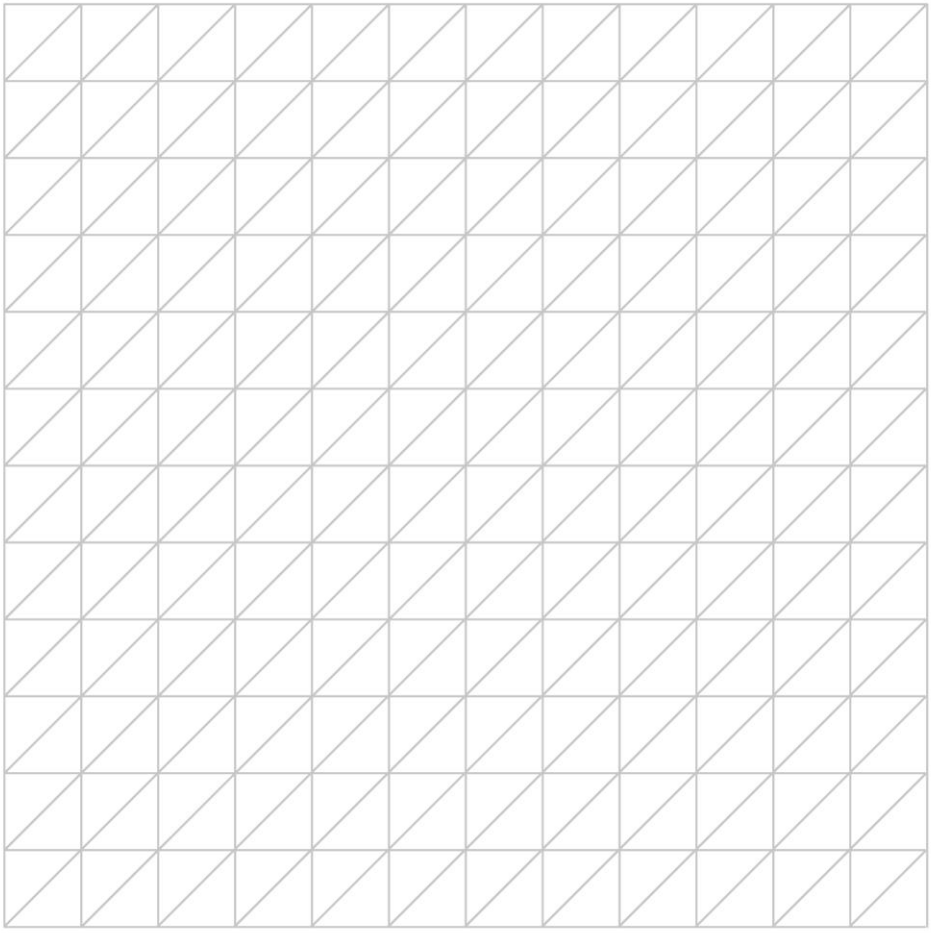
13 Oblique drawing is one method of communicating 3D shapes and designs.

(a)

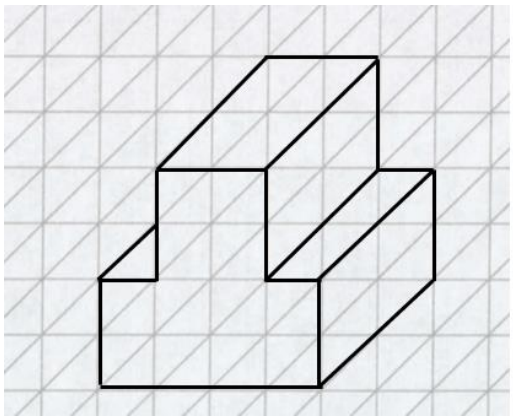
(i) Reproduce the 2D image below as a 3D oblique drawing using the oblique grid provided. Draw the shape to scale of 1:1.

The depth of the shape is equal to the overall length.





[3]



Drawing conventions are of particular importance within the R038/01 specification.

Consequently, marks were given in the following way:

- Front elevation drawn to scale [4x4] (1)
- 3D shape using the front elevation with lines of sight extending back from front elevation (1)
- Oblique drawing using 45o projection lines (1)

Question 13 (a) (ii)

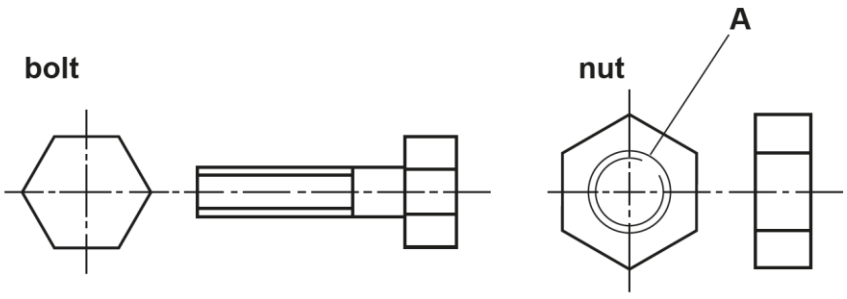
(ii) State **one** other type of drawing used to communicate design outcomes using 3D techniques.

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

This was a very well attempted question with isometric and CAD being very popular responses from candidates.

Question 13 (b) (i)

(b) A hexagonal bolt and nut are shown in the drawing below.



(i) State the mechanical feature shown at **A** on the drawing.

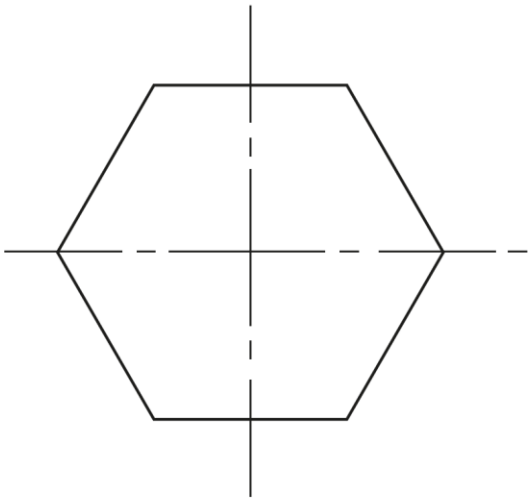
..... **[1]**

Engineering drawing conventions are of particular importance within the R038/01 specification. For this question, only a few candidates correctly stated the mechanical feature shown as a thread.

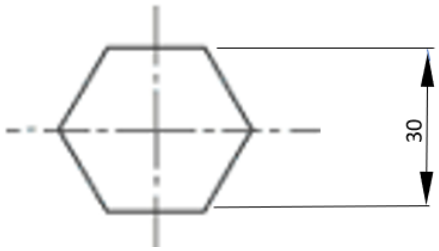
Question 13 (b) (ii)

(ii) Use the correct drawing conventions to draw the Across Flat (AF) measurement of the bolt head of 30 mm on the drawing below.

Drawing shown is not to scale.



[2]



Engineering drawing conventions are of particular importance within the R038/01 specification.

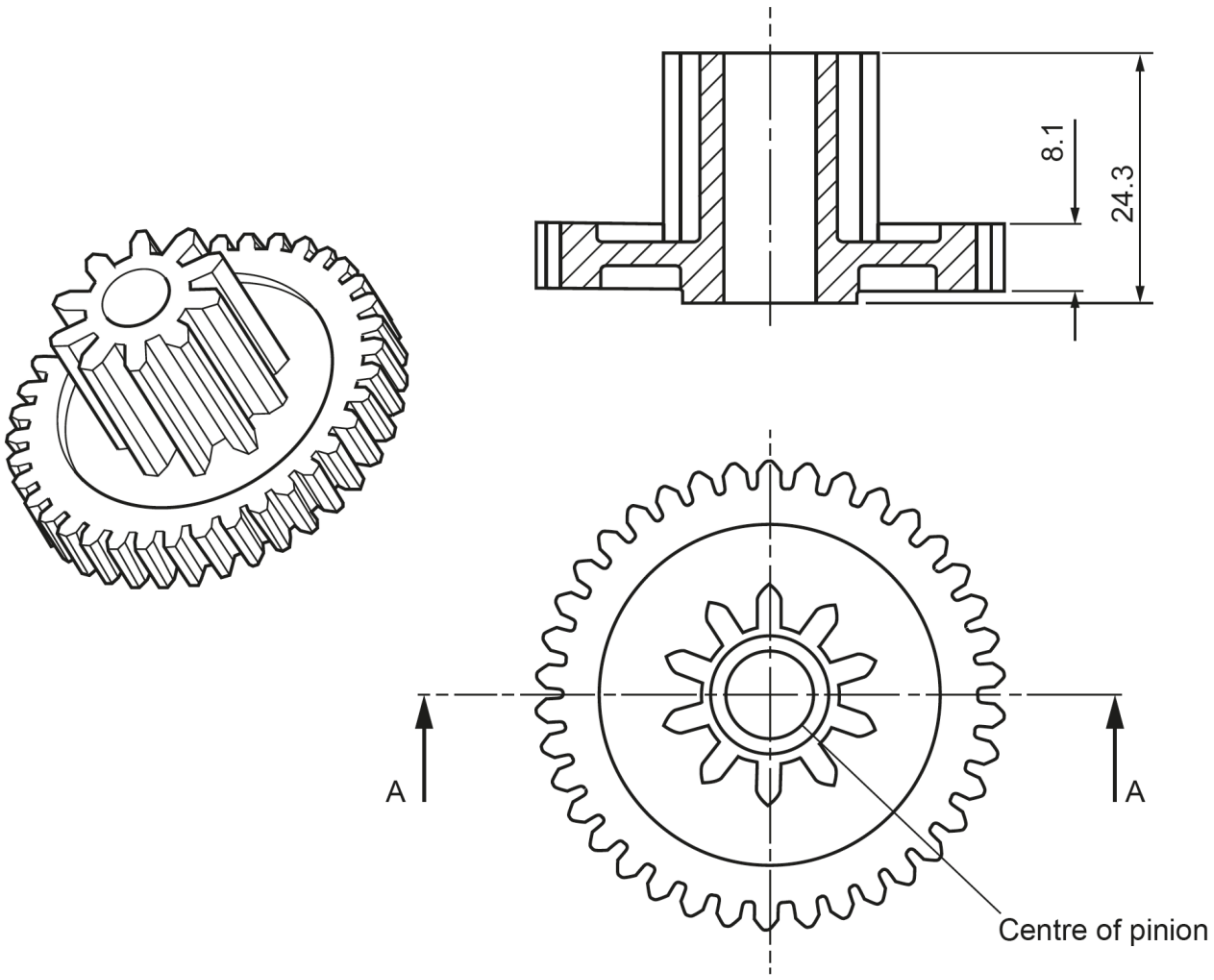
Consequently, marks were given in the following way:

- Correct drawing convention across the flats (1)
- Any one of the following from:
  - Leader lines not touching the shape (1)
  - Correct presentation of dimension – value is above the line (1)
  - The arrowheads should have solid points (1)

Many candidates did not attempt to answer this question. Candidates should be encouraged to attempt all questions to maximise their overall marks. The mark scheme allowed for marks to be given for the correct application of the dimension, even where this was incorrect for the Across Flat measurement.

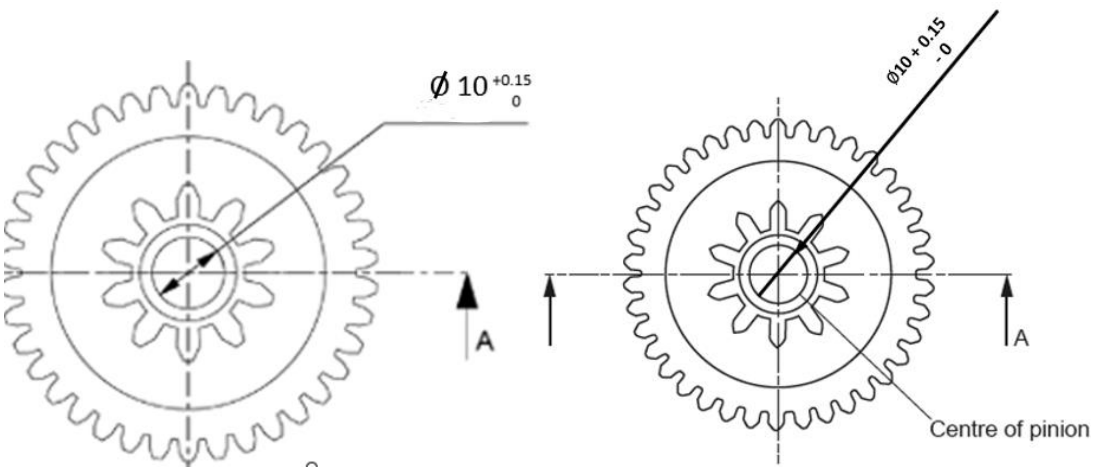
Question 13 (c)

(c) The drawing below shows a spur gear and pinion.



The centre of the pinion has a diameter of 10 mm with a tolerance of up to 0.15 mm larger and 0 mm smaller.

Using standard drawing conventions, add this measurement to the drawing showing the given **tolerance**. **[3]**



Engineering drawing conventions are of particular importance within the R038/01 specification.

Consequently, marks were given in the following way:

- correct convention of the dimension line (1)
- correct application of the leader line (1)
- representation of tolerance, with a + or zero as shown (1)

Accept dimension line with leader line without leg as shown in the example on the right.

Many candidates did not attempt this question part. Of those that did provide an answer, fewer than expected were able to correctly apply the correct leader and dimension lines. However, many candidates that attempted to give a tolerance were able to be given a mark.

Question 14 (a) (i)

14 Sustainable design is important to manufacturers and customers.

(a)
(i) Many classroom chairs are made from polymers.

State why this could make some classroom chairs **less** likely to be purchased.

.....

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

Candidates found this question very accessible, with the most popular answer being that plastics are not easily recyclable. However, there were still a significant number of responses that were totally unrelated to sustainability.

Question 14 (a) (ii)

(ii) Explain **one** way that a designer could research the importance of sustainable design to customers.

.....

.....

.....

.....

.....

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

Many candidates found it challenging to explain one way that a designer could research the importance of sustainable design. Popular correct responses included the use of focus groups and questionnaires to garner the opinions of customers.

Question 14 (b)

(b) Discuss the advantages and limitations of making the aesthetics an important design feature for classroom chairs.
Use examples to support your answer.

.....

.....

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.....

.....

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

Many candidates discussed both the advantages and limitations of making aesthetics an important feature of classroom chairs.

Advantages included making the school/classrooms more attractive and welcoming to students, with some excellent additional explanations on the choice and impact of colour schemes on mood.

The use of a more business-like design that could be utilised in different settings such as the corporate world or universities were also common responses.

There were also some very good discussions around limitations such as the potential overall costs of adding aesthetic features, as well as possibly losing the core task of a classroom chair which it to be comfortable for prolonged use.

This is a Level of Response question with the many candidates either achieving Level 1 or Level 2. Some candidates only covered one side of the discussion.

Some candidates achieved Level 3, demonstrating a thorough understanding of the advantages and limitations with consistent use or appropriate terminology.

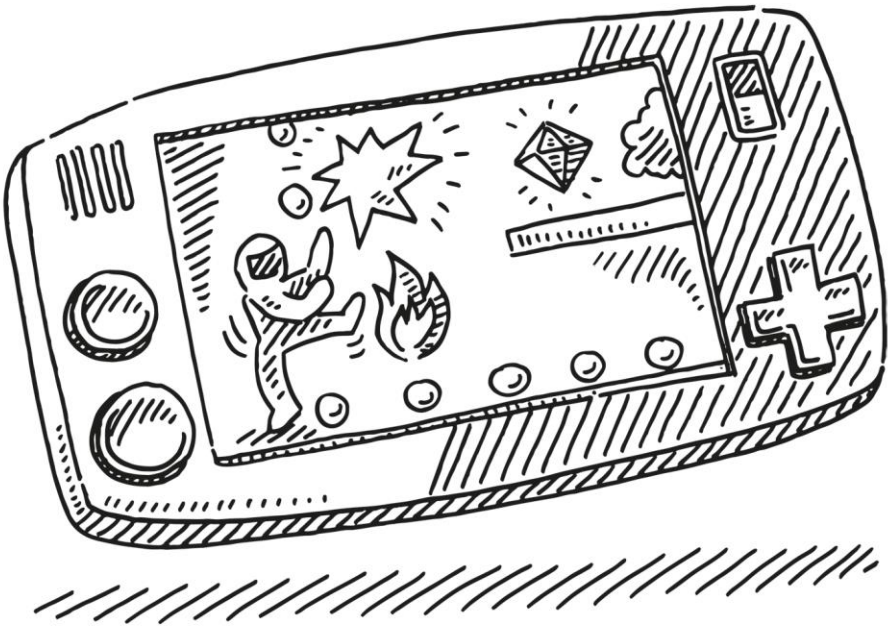
Exemplar 1

The advantages of aesthetics a used are that they may look more appealing and fit the look of the classroom. The students may want to sit on these chairs if the colours stand out which makes it easier to pick. The limitations of this is that it may come at a cost of comfort or the sturdyness of the chair. Another limitation is that they may not fit everyones liking. **[6]**

The exemplar is a Level 3 response attaining 5/6 marks available. The response demonstrates a clear and coherent understanding of the advantages and limitations of making aesthetics an important feature of classroom chairs and gives several valid reasons for this.

Question 15 (a) (i)

15 A drawing of a hand-held games console is shown below.



(a)
(i) State the type of drawing shown.

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

Candidates often stated freehand sketch as the correct answer. There were also some candidates that incorrectly stated oblique or isometric.

Question 15 (a) (ii)

(ii) State **one** function that is shown to be included in the design of the hand-held games console.

.....

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

Candidates found this question very accessible, with such functions as a speaker, display screen, controls or switches often stated.

Question 15 (a) (iii)

(iii) Describe how **technology push** can influence the features and functions of products such as the hand-held games console.

.....

.....

.....

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

Candidates appeared to either understand technology push and therefore articulated their description seemingly easily or they did not understand the term and could not describe how it influenced the features and functions of products such as the hand-held game.

Question 15 (a) (iv)

(iv) Explain **two** ways that **ergonomic** considerations have been used in the design of the hand-held games console.

1 .....

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.....

.....

2 .....

.....

.....

.....

[4]

Candidates were able to explain two ways that ergonomic considerations have been used in the design of the hand-held games console.

Comfortable access to the controls was a very popular response.

Texture, finish and the overall size of the hand-held game were also well explained and often supported the award of full marks.

Overall, a very well understood topic with many candidates gaining at least 2 marks and often more.

Question 15 (b)

(b) Explain how the scale of manufacture could influence the **manufacturing processes** used to produce a product, such as the hand-held games console.

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.....

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

Candidates found it very challenging to explain how the scale of manufacture could influence the manufacturing processes used to produce a product.

Exemplar 2

if you are only Manufacturing a few then this can easily be achieved by manufacturing them by hand. However if you are mass producing then then the manufacturing process would have to be done via machine **[2]**

Full marks was given to this response which had a clear understanding of the impact of scale of production on manufacturing processes.

Question 16 (a) (i)

16 The image below shows an existing design of modern headphones used to inspire a new design.

(a)
(i) Interviews with consumers identified a range of desirable criteria and product functions.

This type of research is called ..... **[1]**

Candidates often gave the correct answer or primary research, although a number did get confused and state secondary research.

Question 16 (a) (ii)

(ii) The table below shows a comparison of product functions for headphone design ideas included in the design brief.

Cost and size limitations prevent any one of the three designs from having all of the design function criteria listed.

	Headphones Design Options		
Function Criteria	**Design A**	**Design B**	**Design C**
Adjustable left/right sound balance	✓	✓	✓
Foldable to fit in portable case 15 cm × 12 cm × 8 cm	✓	✗	✗
Waterproof	✗	✓	✓
Wireless Bluetooth capability	✓	✓	✓
30–40 hour battery life	✓	✗	✗
Fast charging	✓	✓	✗
Consumer cost range (£)	High	Medium	Low

Using the information in the table, **discuss** the reasons for choosing either design A, B or C for the final design.

.....

.....

.....

.....

.....

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

Candidates enjoyed the opportunity to discuss the reasons for choosing either design A, B or C for the final design and often made numerous insightful comments that enabled them to gain good marks and, in many cases, full marks.

Question 16 (a) (iii)

(iii) A designer may be asked to **modify** a design to be more **sustainable**.

Within the 6Rs, this is known as **R** ..... **[1]**

Many candidates correctly stated Rethink. However, we also saw many incorrect answers with all of the other 6Rs cited.

Question 16 (a) (iv)

(iv) Explain **one** way that the design of the headphones could be changed to become more sustainable.

.....

.....

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.....

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

A very broad range of different responses on this question. Ergonomics was often incorrectly used.

Changing or reducing the material used in manufacture and having replacement parts to extend the life of headphones were popular answers.

Unfortunately, we rarely saw coherent answers that worked through a scenario related to the design of headphones to justify the impact on the design and subsequently the environment.

Exemplar 3

The headphones could be made out of a recyclable material/plastic, that then can be ~~made~~ reused for another purpose,

An example scenario given with clear understanding of the impact the allowing disassembly and repair has on the longevity of the headphones.

Question 16 (b)

(b) Some products are designed to function correctly for a preset period of time before they become unusable or can no longer be used efficiently.

This is called **Planned** ..... **[1]**

Candidates found it very challenging to correctly state planned obsolescence.

Copyright information

Question 15 (a) (i): Handheld Video game, https://www.istockphoto.com/vector/handheld-video-game-drawing-gm1224795232-360277614?phrase=games+controller+sketch+&searchscope=image%2Cfilm © FrankRamspott / iStockphoto.

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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 **three types** of online course for Cambridge Nationals.

All teachers delivering our redeveloped Cambridge Nationals suite from September 2022 are asked to complete the course **Essentials for the NEA**, which describes how to guide and support your students. **You'll receive a certificate which you should retain**.

Following this you can also complete a subject-specific **Focus on Internal Assessment** course for your individual Cambridge Nationals qualification, covering marking and delivery of the NEA units.

We have also created subject-specific **Understanding the examined unit** courses that provide a wealth of information to support you with the delivery, assessment, and administration of the examined unit. The courses outline the assessment structure, including details on synoptic assessment, performance objectives and command words for your Cambridge Nationals qualification. Working through the course, you have an opportunity to interact with resources developed to support the exam, in particular candidate exemplars and mark scheme guidance. The final section covers details on administrative requirements, including assessment opportunities, entry rules and resits.

How can you get support and feedback?

If you have any queries, please contact our Customer Support Centre on 01223 553998 or email support@ocr.org.uk.

We welcome your feedback and suggestions on how to improve the online courses and make them more useful and relevant for you. You can share your views by completing the evaluation form at the end of each course.

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on
01223 553998

Alternatively, you can email us on
support@ocr.org.uk

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We really value your feedback

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