OCR
Oxford Cambridge and RSA

Wednesday 8 January 2025 – Morning

Level 1/Level 2 Cambridge National in Engineering Design

R038/01 Principles of engineering design

Time allowed: 1 hour 15 minutes

You must have:
- a ruler (cm/mm)

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

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for diagrams.
- 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 millimetres unless the question says something different.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A

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

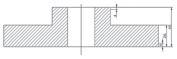
1 Which of these represents the diameter on an engineering drawing?

(a)  ☐

(b) 

☐

(c)  ☐

(d)  ☐ **[1]**

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]**

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]**

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]**

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

(a) Centre line ☐

(b) Chamfer ☐

(c) Scale ☐

(d) Tolerance ☐ **[1]**

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]**

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]**

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]**

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]**

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]**

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Section B

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]

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

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

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

1 .....

2 .....

[2]

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

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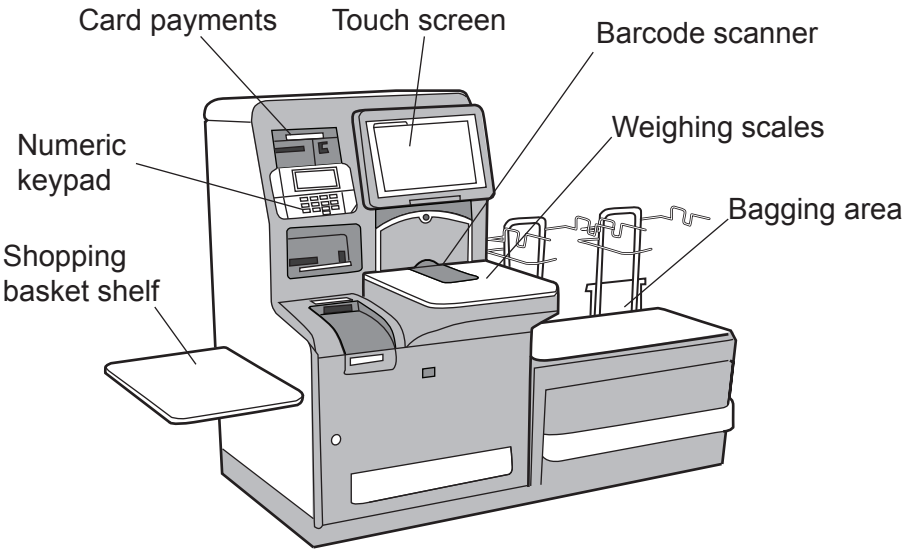
..... **[3]**

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 .....

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2 .....

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[2]

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

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(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.

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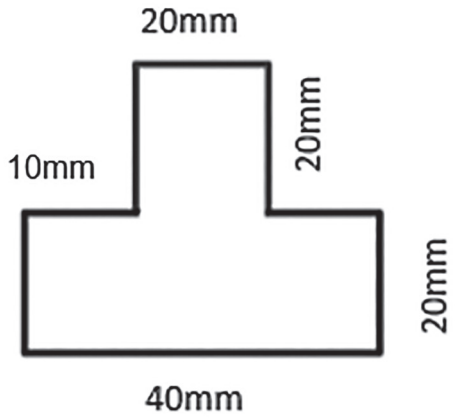
..... **[2]**

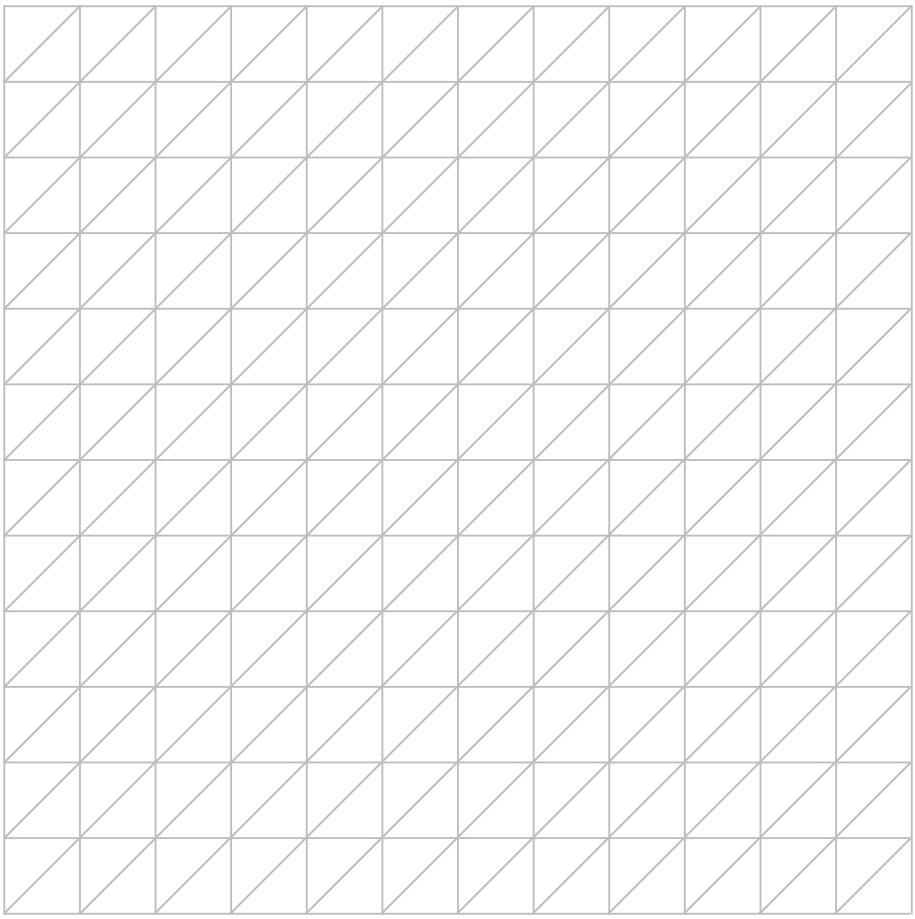
13 Oblique drawing is one method of communicating 3D shapes and designs.

(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.



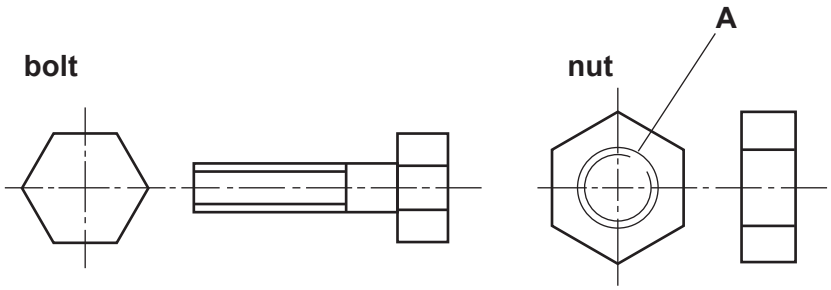


[3]

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

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

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

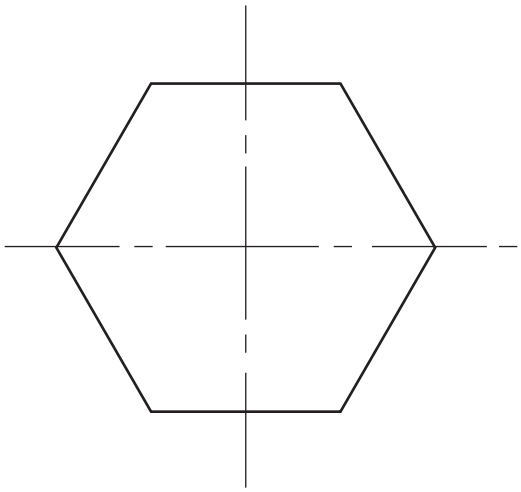


(i) State the mechanical feature shown at **A** on the drawing.

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

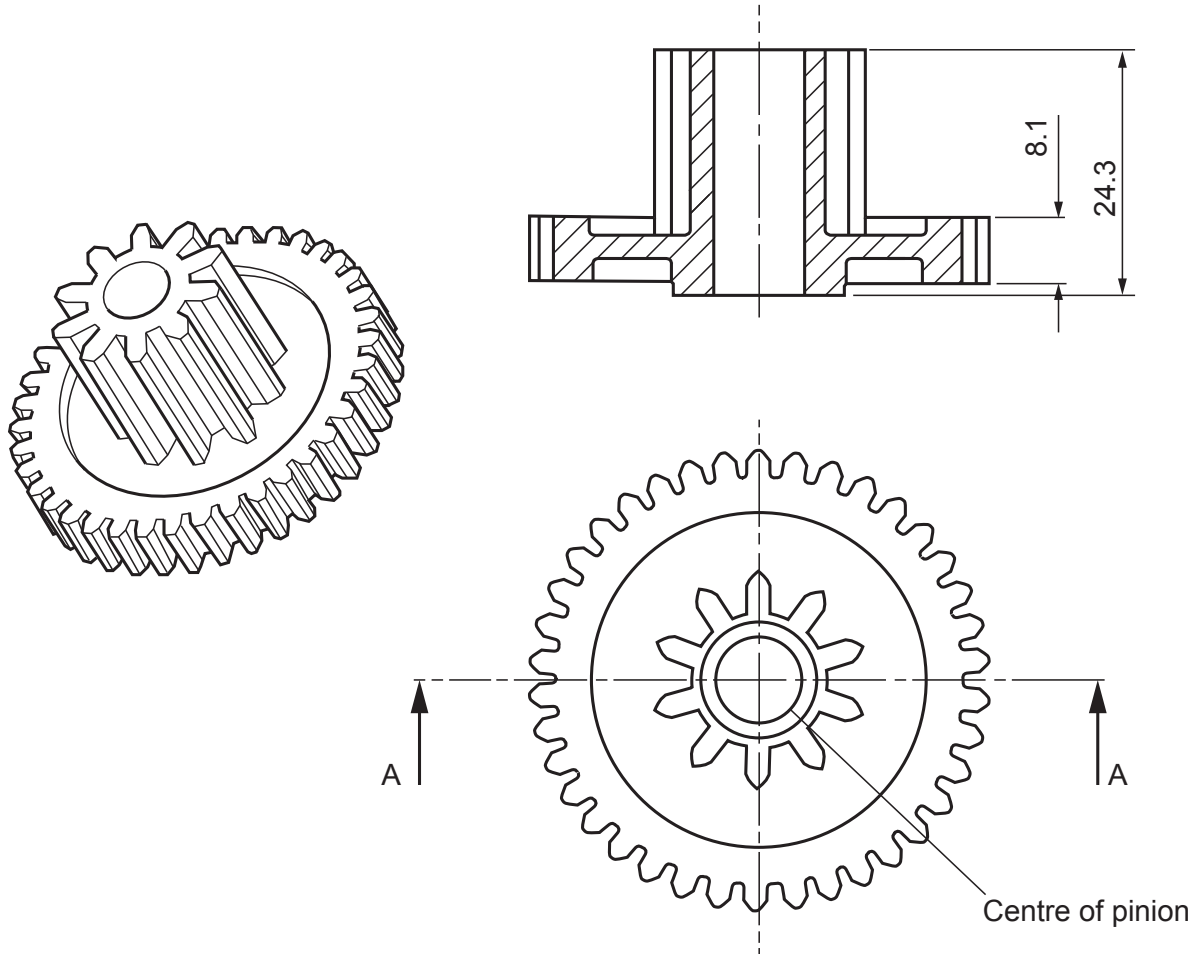
(ii) Use the correct drawing conventions to draw the Across Flat (AF) measurement of the bolt head of 30 mm on the drawing below.

Drawing shown is not to scale.



[2]

(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]**

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.

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

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

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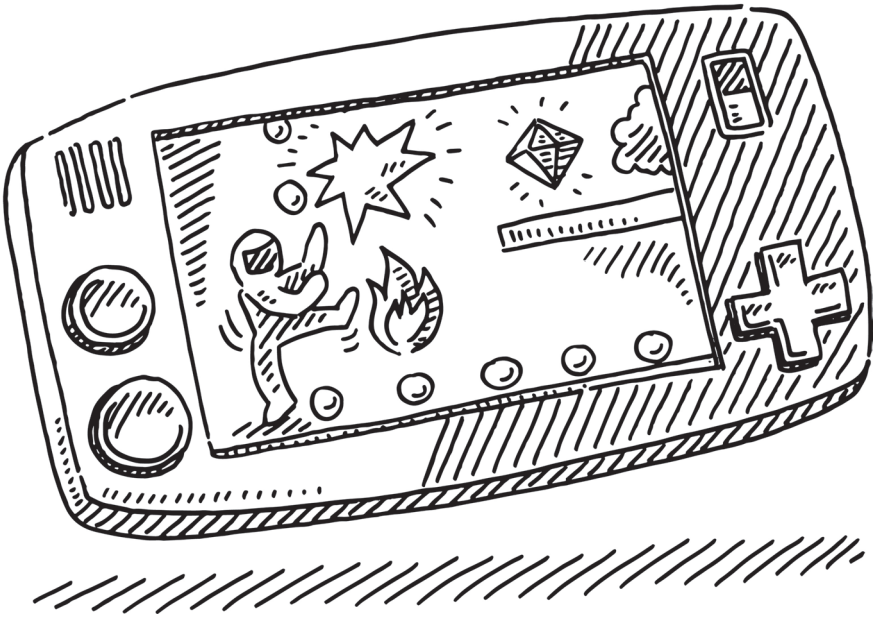
..... **[6]**

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



(a)

(i) State the type of drawing shown.

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

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

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

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

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

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

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2 .....

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[4]

(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]**

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]**

(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.

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

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

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

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

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

(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]**

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