

Modified Enlarged 24pt
OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Tuesday 13 May 2025 – Morning

**Level 1/Level 2 Cambridge National in
Engineering Design**

R038/01 Principles of engineering design

**Time allowed: 1 hour 15 minutes
plus your additional time allowance**

YOU MUST HAVE:
a ruler (cm/mm)

Please write clearly in black ink.

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

First name(s) _____

Last name _____

READ INSTRUCTIONS OVERLEAF



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.

ADVICE

Read each question carefully before you start your answer.

BLANK PAGE

SECTION A

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

1 Which of these would typically be made as a one-off product? [1]

(a) Nut and bolt

☐

(b) Prototype gear assembly

☐

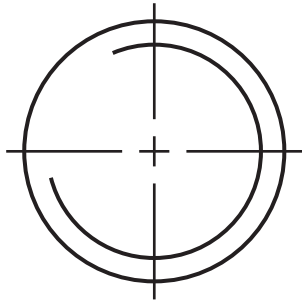
(c) Radiator

☐

(d) Washing machine

☐

2 Which of these mechanical features does the drawing show? [1]



(a) Chamfer

☐

(b) Countersink

☐

(c) External thread

☐

(d) Hole

☐

3 Which of these is an example of an aesthetic feature? [1]

(a) Colourful graphics

☐

(b) Large, easy to read icons

☐

(c) Soft grip handle

☐

(d) Suitable for any age range

☐

4 Which of these is an example of quantitative comparison? [1]

- (a) Checking if the client likes the product** ☐
- (b) Checking the correct number of material parts are ordered to make the product** ☐
- (c) Comparing the size of the product with the client's specifications** ☐
- (d) Comparing user testing responses on favourite product features** ☐

5 Which of these is the correct scale for a component drawn at half the size of the component? [1]

- (a) 1 : 2** ☐
- (b) 1 : 50** ☐
- (c) 2 : 1** ☐
- (d) 50 : 1** ☐

6 Which of these correctly describes ergonomic design? [1]

(a) A design that uses human measurements avoiding oversized parts to save materials

☐

(b) A design that uses human measurements to ensure the 90th percentile of the population can use the product

☐

(c) A design that uses human measurements to ensure the product is comfortable and easy to use

☐

(d) A design that uses materials to ensure a long product lifecycle

☐

7 Which of these is an ADVANTAGE of secondary research? [1]

- (a) Manufacturer's detailed technical design information is always available** ☐
- (b) Only the designer has access to the information used for the research** ☐
- (c) The information available is often free** ☐
- (d) The information is always up to date** ☐

8 Which of these would be included in the title block of an engineering drawing? [1]

- (a) Author's name / who the drawing is by** ☐
- (b) Capital costs** ☐
- (c) Legislation requirements** ☐
- (d) Recycling information** ☐

9 Which of these tools would be used to check an internal measurement of a component accurately? [1]

(a) Micrometer

☐

(b) Steel rule

☐

(c) Tape measure

☐

(d) Vernier callipers

☐

10 Which of these angles is used to draw out lines to represent depth in an oblique drawing? [1]

(a) 15°

☐

(b) 30°

☐

(c) 45°

☐

(d) 60°

☐

SECTION B

- 11 The image opposite shows a structural slotted angle. The structural slotted angle can be used for a variety of support applications.**

A designer is developing a design for a heavy-duty structural slotted angle similar to the one shown opposite.



The designer is using the design brief and specification shown below.

DESIGN BRIEF:

To produce corrosion resistant heavy-duty structural slotted angle in 1, 2 and 3 metre lengths.

(a)

- (i) Complete the design specification table for the heavy-duty structural slotted angle by adding in the missing requirements next to each criteria.**

Some requirements have been completed for you. [4]

DESIGN SPECIFICATION:

CRITERIA	SPECIFICATION REQUIREMENTS
Aesthetics	
Cost	Maximum £8.40 /m
Customer	Industry / trade
Working environment	
Dimensions / Size	40 mm × 40 mm available in 1, 2 and 3 metre lengths
Function	
Material	
Manufacturing	Press folded and punched

- (ii) Draw and label a FREEHAND SKETCH of the heavy-duty structural slotted angle to match the requirements in the design specification.**

Use the space below. [2]

(iii) The heavy-duty structural slotted angle is produced using a press to fold the material.

Identify ONE other manufacturing process that would be used to produce the heavy-duty structural slotted angle.

_____ **[1]**

(iv) Explain how material availability and form can influence the design and manufacture of the heavy-duty structural slotted angle.

_____ **[3]**

12 Additive manufacturing is increasingly being used to model and manufacture finished products. 3D printing is one type of additive manufacturing.

(a) The table opposite shows the key stages of 3D printing.

Complete each stage of the table by adding the missing description from the list below.

One has been completed for you. [3]

3D Printing

Computer generated design created

Post processing

Setting up the machine ready for printing

~~Slicing – Transforming STL file to G-code~~

Key stages of 3D printing	
	Description of key stage
Stage 1	
Stage 2	Slicing – Transforming STL file to G code
Stage 3	
Stage 4	
Stage 5	

(b)

- (i) Identify ONE advantage of using additive manufacturing to create a model instead of using traditional tools and machines.**

[1]

- (ii) Describe ONE way 3D printing differs from making physical models using traditional tools and machines.**

Use ONE example to support your answer.

[3]

(iii) Identify ONE type of filament material that can be used for 3D printing.

_____ **[1]**

(iv) Explain ONE reason why post processing of 3D printed parts is often necessary before the component is ready to use.

_____ **[2]**

13 The drawing opposite shows a bush bearing used in a pump.

(a)

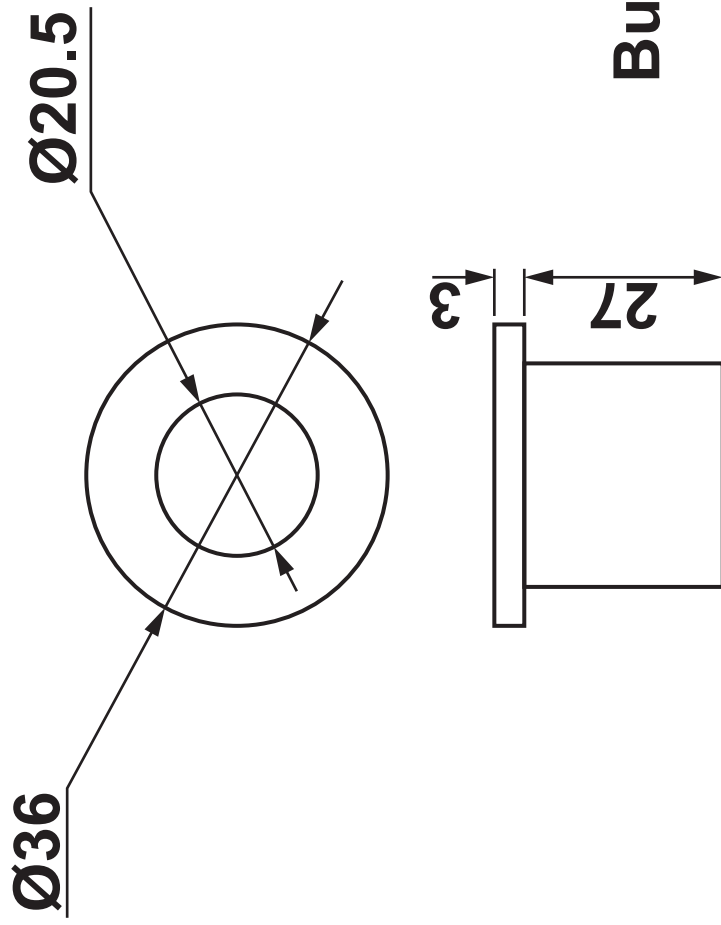
(i) Label the isometric view. [1]

(ii) Draw the centre line through the plan view using standard drawing conventions. [2]

(iii) Add a dimension of 26 mm to show the width of the front view. [3]

(iv) Explain ONE reason why it would be important to create a physical model of the bush from the drawing.

[2]



Bush bearing – Not to scale

(b) The drawing of the bush has been drawn using CAD.

Describe ONE way the use of CAD can benefit the design process.

[2]

BLANK PAGE

14 Planned obsolescence is where a company designs products with a deliberate plan to limit the lifespan of the product.

(a)

(i) Describe ONE way a designer could purposely build in planned obsolescence to an electrical/electronic device or household appliance.

Use ONE example to support your answer.

[3]

(ii) Explain ONE drawback of a design strategy that uses planned obsolescence.

[2]

(b)

- (i) Product disassembly is one method of analysing existing products.**

Describe ONE resource you would need to disassemble a product.

[2]

- (ii) Explain ONE reason why product disassembly may NOT be possible for some products or components.**

[2]

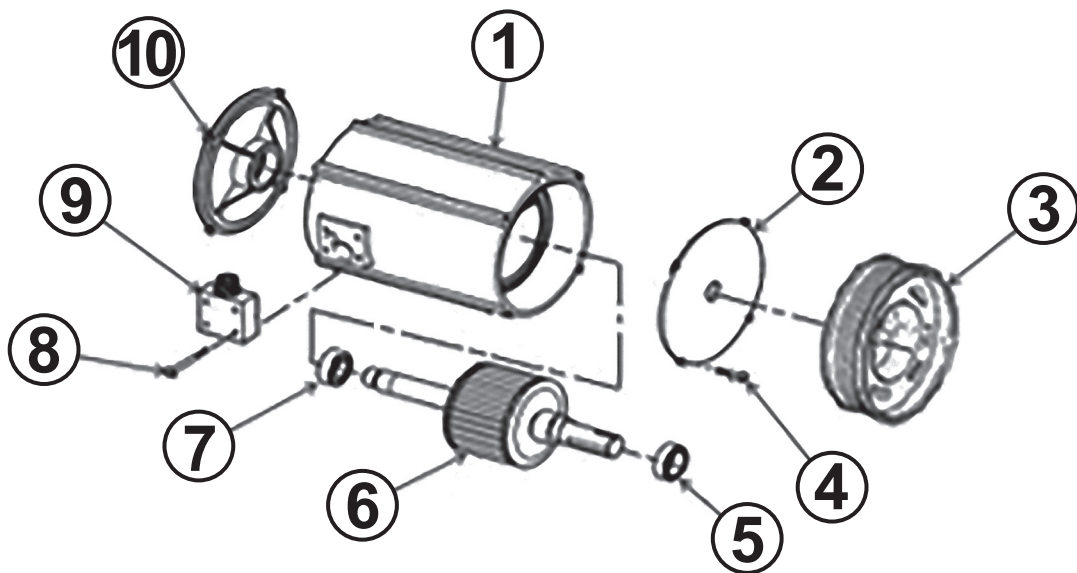
(c) What does this mark mean?

**UK
CA**

[1]

15 An assembly drawing of an electrical motor is shown below.

ITEM	QTY	Name
1	1	Yoke
2	1	Front Housing
3	1	Pulley
4	4	Screw
5	1	Front Bearing
6	1	Armature
7	1	Rear Bearing
8	4	Screw
9	1	Electrical connection
10	1	Rear Housing



(a)

(i) Describe how this type of drawing could be used for secondary research.

[2]

(ii) Explain why this type of drawing would NOT be enough to allow a manufacturer to make the components shown.

[2]

(b) A company designs and makes drones that people fly as a hobby.

The design of the drones is continually evolving as new features are added. The drones are manufactured in batches according to the unique features for each model. Assembly is done by hand but this method is becoming too expensive and time consuming.

The company wants to speed up the assembly processes involved in making the drones.

Discuss whether changing the design would speed up the assembly process.

[6]

16 A flow chart has been produced for the design of a safety interlock for a workshop milling machine. The safety interlock is designed to put the machine in a safe mode until the safety procedures are put in place by the operator. The safety interlock will only be disengaged once the machine is safe to operate.

(a) Complete EACH STAGE of the flow chart for the safety interlock using stages from the list below.

Some stages have been completed for you. [3]

Disengage interlock

Is the safety visor guard moved into place?

Yes

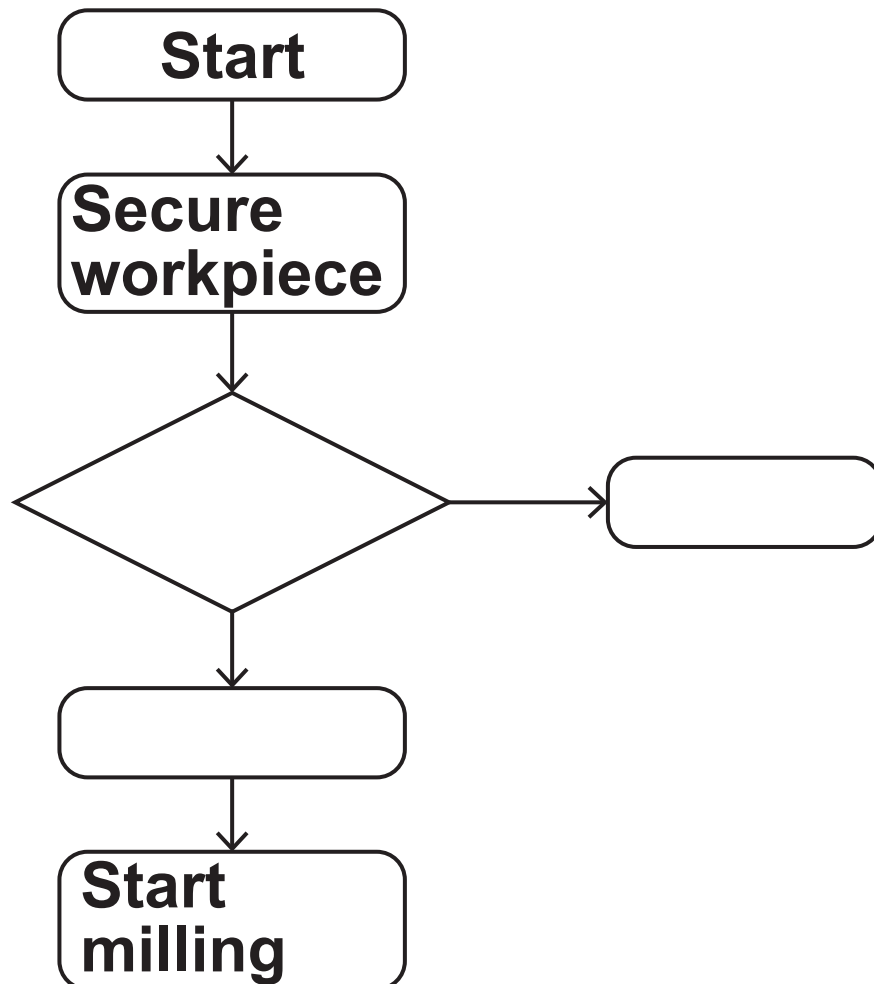
No

Start

~~Secure workpiece~~

~~Start milling~~

Move visor guard into place



(b) Many electrical products in the home have a standby mode which helps save energy when an electronic device is not in use. It allows the device to quickly resume its previous state when you start to use it again. In standby mode, the device remains in a low-power state, consuming a small amount of electricity. Usually, a small LED is lit to show the product is in standby mode.

Analyse how standby mode meets the principles of sustainable design.

[4]

- (c) Recycling and Rethinking the design are two approaches to sustainable design.**

Identify ONE other approach to sustainable design.

_____ **[1]**

- (d) Explain ONE way primary research of existing products could be used to determine suitable materials for a new product.**

_____ **[2]**

END OF QUESTION PAPER



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of Cambridge University Press & Assessment, which is itself a department of the University of Cambridge.