OCR
Oxford Cambridge and RSA

Wednesday 10 January 2024 – 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)

R038/01

14352631139

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 **16** 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 products would typically be mass produced?

(a) Bridge ☐

(b) Canned food ☐

(c) Handmade jewellery ☐

(d) Racing car ☐ **[1]**

2 Which of these views are shown in a third angle orthographic projection drawing?

(a) 30° face and side, top ☐

(b) Front, right side, top ☐

(c) Front, top, left side ☐

(d) Top, side, exploded ☐ **[1]**

3 Which of these is an example of 'Refuse' within the 6Rs?

(a) Refusing to only buy organic materials ☐

(b) Refusing to only use wind energy sources ☐

(c) Refusing to use an unsustainable raw material ☐

(d) Refusing to use composite materials in a design ☐ **[1]**

4 Which of these is an example of anthropometric data?

(a) A measurement of eye level ☐

(b) A measurement of the height of a chair seat ☐

(c) The distance of a user's wrist to a keyboard ☐

(d) The size of the average computer mouse ☐ **[1]**

5 Which of these manufacturing processes involves making three dimensional solid objects in layers from a digital file?

(a) 3D printing ☐

(b) Shaping ☐

(c) Turning ☐

(d) Wasting ☐ **[1]**

6 Which of these materials is most suitable for making a concept model that does **not** need to be physically tested?

(a) Aluminium ☐

(b) Carbon fibre ☐

(c) Card ☐

(d) Epoxy resin ☐ **[1]**

7 Which of these is a product criterion included in a design specification?

(a) Assembly instructions ☐

(b) Cost ☐

(c) Labour ☐

(d) Production of models ☐ **[1]**

8 At which stage of the design process would a freehand sketch be used?

(a) To communicate how the design will look in the intended environment ☐

(b) To communicate technical features of the design ☐

(c) To present final design ideas ☐

(d) To present initial concept design ideas ☐ **[1]**

9 Which of these statements is a correct description of market pull?

(a) Customers demanding a product is removed from the market ☐

(b) Customers demanding lower price mobile phones ☐

(c) Designers adding a new feature in response to customer feedback ☐

(d) Designers building in features that will only work for a limited time ☐ **[1]**

10 Which of these manufacturing processes is an example of wasting?

(a) Disposal of materials into landfill ☐

(b) Not recycling plastic bottles ☐

(c) Pouring molten metal into a mould ☐

(d) Routing a channel in a piece of wood ☐ **[1]**

Section B

11 A designer has been given a brief to design a child's toy.

The table below shows a range of product design requirements.

(a)

(i) Complete **each column** of the table by adding in the missing requirements **under** each heading.

Some requirements have been completed for you.

Child's toy			
User requirements	**Product safety requirements**	**Material safety requirements**	**Manufacturing requirements**
Suitable for boys and girls			*Readily available materials*
Educational			*Can be moulded in a range of colours*
Accessible interactive features and functions (buttons/lights)	*Safe to use in a range of environments*	*Flame resistant*	

[5]

(ii) Identify **one** method of **primary** research that could be used when considering suitable interactive features and functions for the child's toy.

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

(b) Describe how designers can ensure the child's toy is suitable for its intended customers.

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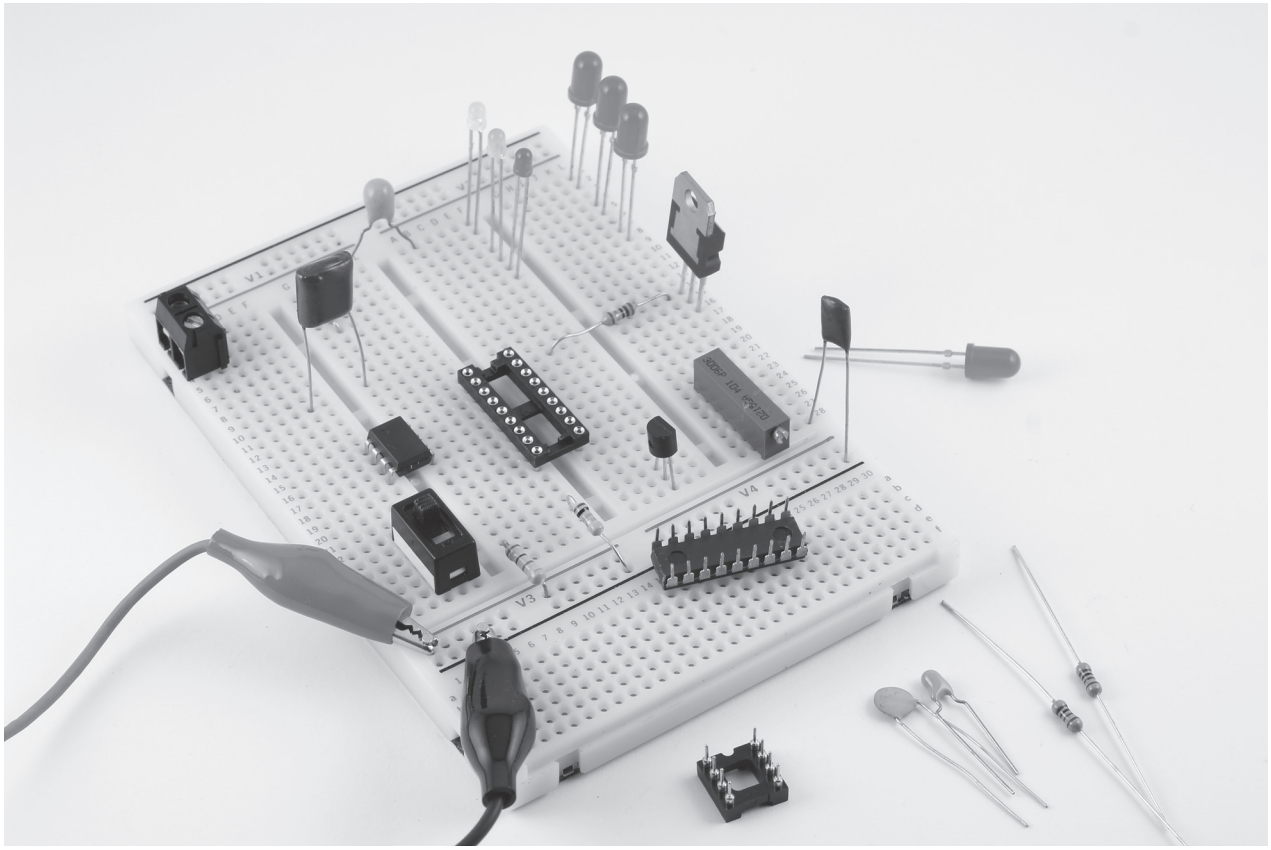
..... **[2]**

(c) **Fig. 1** shows a breadboard that is used to experiment with making circuit designs, for example a circuit with lights and switches for modelling purposes.

Fig. 1



Identify **two** limitations of using breadboarding compared to on-screen simulation.

1 .....

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2 .....

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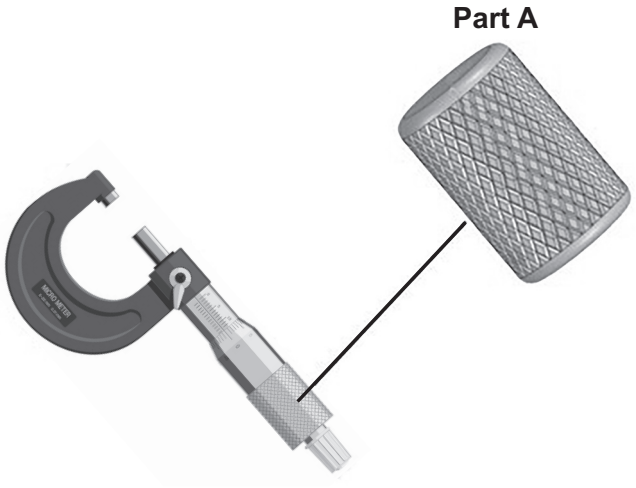
[2]

12 **Fig. 2** shows a CAD model of a tool. Part of the tool is enlarged and labelled **Part A**.

Fig. 2



(a)

(i) Identify the mechanical feature used for the finish on **Part A**.

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

(ii) Complete the drawing below to add how the mechanical feature you have identified would be represented on an engineering drawing.

[1]

(iii) Describe how ergonomic considerations have influenced the use of this mechanical feature on the tool.

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

(iv) Other than ergonomics, identify **one** reason why a surface finish would be applied to a tool.

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

(b) Orthographic drawings often include lines that show hidden details.

Identify **one** example of an engineering drawing feature where hidden details would be used.

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

(c) Describe, using an example, how the design of a handheld tool can be affected by its intended purpose.

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

13 A new design for an office chair is being developed.

(a)

(i) Identify **two** methods of **secondary** research that could be used to influence the design work.

1 .....

2 .....

[2]

(ii) Describe how secondary research sources could be used to provide ideas for the aesthetics of the design of the office chair.

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

(iii) Describe, using an example, how the design of the office chair could be affected by the choice of manufacturing process.

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

(b) Explain the advantages of using user testing to evaluate the design of the office chair.

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

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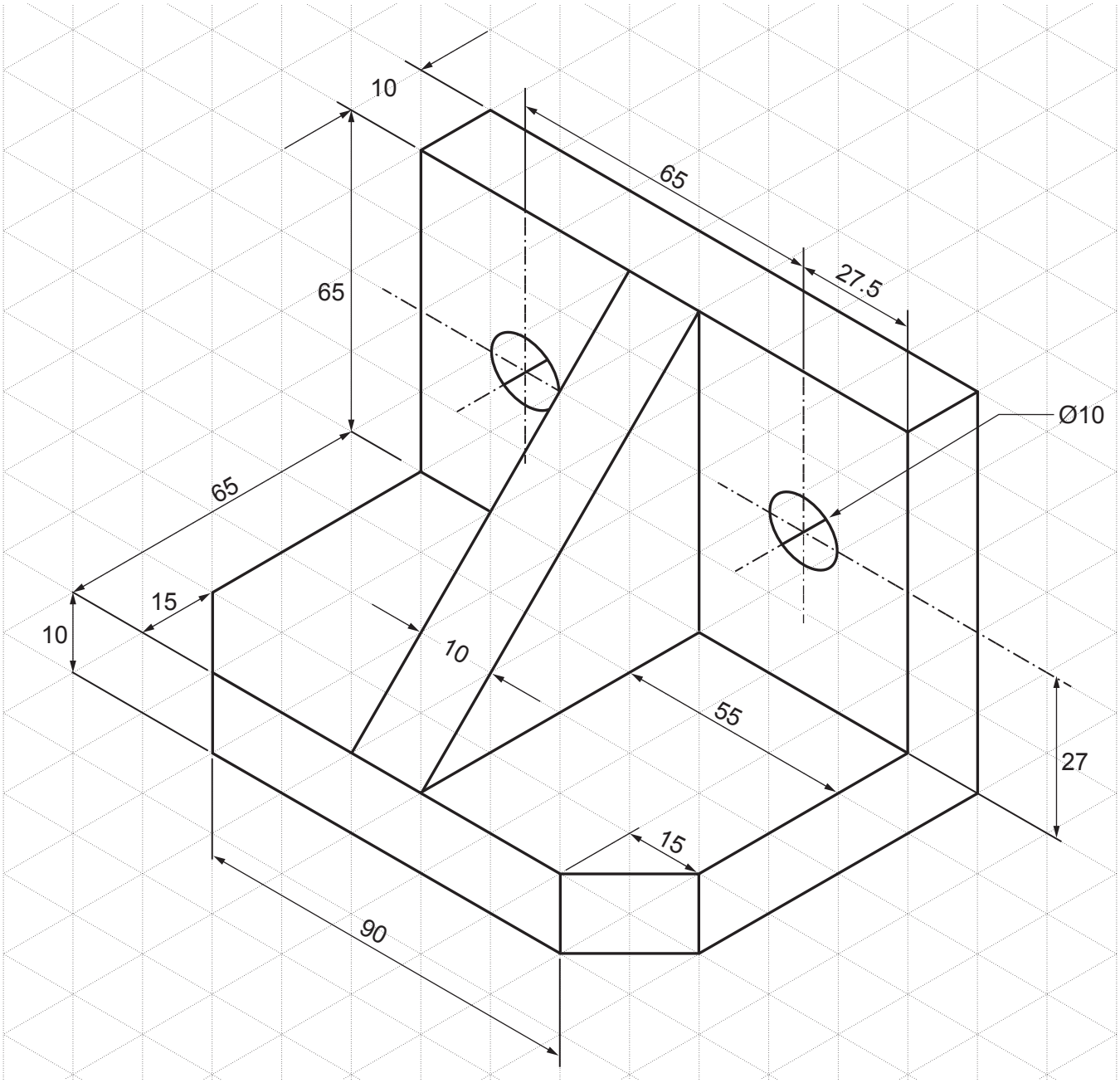
14 **Fig. 3** shows an isometric drawing of a bracket.

Fig. 3



(not to scale)

(a)

(i) In the space provided, draw the **shape** of the **top view** in third angle orthographic projection.

[3]

(ii) The overall bracket length is 120 mm.

Add this dimension to your drawing in **part (a)(i)** using the correct engineering drawing conventions. **[4]**

(iii) Other than dimensions and hidden details, identify **two** pieces of information that would be shown on an orthographic drawing.

1 .....

2 .....

[2]

(b) Identify the abbreviation used for 'across flats' in engineering drawings.

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

15

(a) Sustainable design is an important consideration when designing electrical products.

Complete the table by identifying **two** ways electrical products can be designed to become more sustainable.

Some example answers have been provided for you.

Design ideas for sustainability
Automatically switched off if left on for a long time
Designed to reduce energy usage

[2]

(b) Describe how legislation can influence the design of electrical products used in the home.

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

(c) An engineering company is proposing to import materials from overseas to use as part of a sustainable design strategy.

Discuss the impact on the **environment** of importing materials from overseas/other countries.

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

16 A range of factors can influence product design.

(a) Describe how British and international standards impact on product design.

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

(b) Reverse engineering is one method of analysing existing products.

Identify **two** ways disassembly of competitors' products can inform manufacturing methods for a new product.

1 .....

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2 .....

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[2]

(c) Describe, using an example, how labour costs could affect product assembly methods.

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

(d) OCR Car Wheels is a company that manufactures alloy wheels.

Used car wheels are bought in and re-manufactured to make them look like new. Wheels that cannot be re-manufactured are disposed of and some may go to landfill.

Analyse how this approach meets the key principles of the circular economy.

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

END OF QUESTION PAPER

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