OCR
Oxford Cambridge and RSA

Monday 19 June 2023 – Morning

GCSE (9–1) Design and Technology

J310/01 Principles of Design and Technology

Time allowed: 2 hours

You must have:
- the Insert (inside this document)

You can use:
- a scientific calculator
- a ruler (cm/mm)
- geometrical instruments

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 graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Use the Insert to answer the questions in Section B.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **28** pages.

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

SECTION A

1 Images of a suitcase are shown below.

(a) The suitcase is made from synthetic fabric.

(i) What is a synthetic fabric?

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

(ii) Name **one** synthetic fabric.

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

(iii) Give **two** reasons why synthetic fabric is a suitable material for the suitcase.

1 .....

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2 .....

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[2]

(b) The zips and wheels are standard components.

Describe **two** benefits to the manufacturer of using standard components for the suitcase.

1 .....

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2 .....

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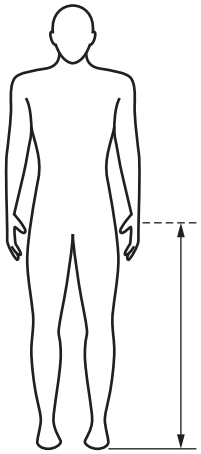
[4]

(c) **(i)** Use the anthropometric data below.

The height-adjustable handle makes the suitcase suitable for a range of users.

Identify the **minimum** and **maximum** height appropriate for this handle to fit the widest range of users.



Floor to Fist grip height (in mm)			
	5th percentile	**50th percentile**	**95th percentile**
Men	700	765	830
Women	670	720	770

Minimum height ..... mm

Maximum height ..... mm

[2]

(ii) Explain why these two measurements are appropriate.

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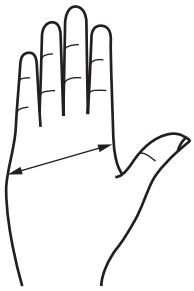
..... **[1]**

(iii) Use the anthropometric data below to identify a suitable **width** for the height-adjustable handle.



Hand breadth (in mm)			
	5th percentile	**50th percentile**	**95th percentile**
Men	80	90	100
Women	70	80	90

Width of handle ..... mm **[1]**

(iv) The adjustability of the suitcase handle makes it ergonomic.

Explain **two** other ergonomic features of the suitcase.

1 .....

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2 .....

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[2]

(d) Evaluate the importance of considering ergonomics when designing products.

To support your answer, refer to products, other than a suitcase, that you are familiar with.

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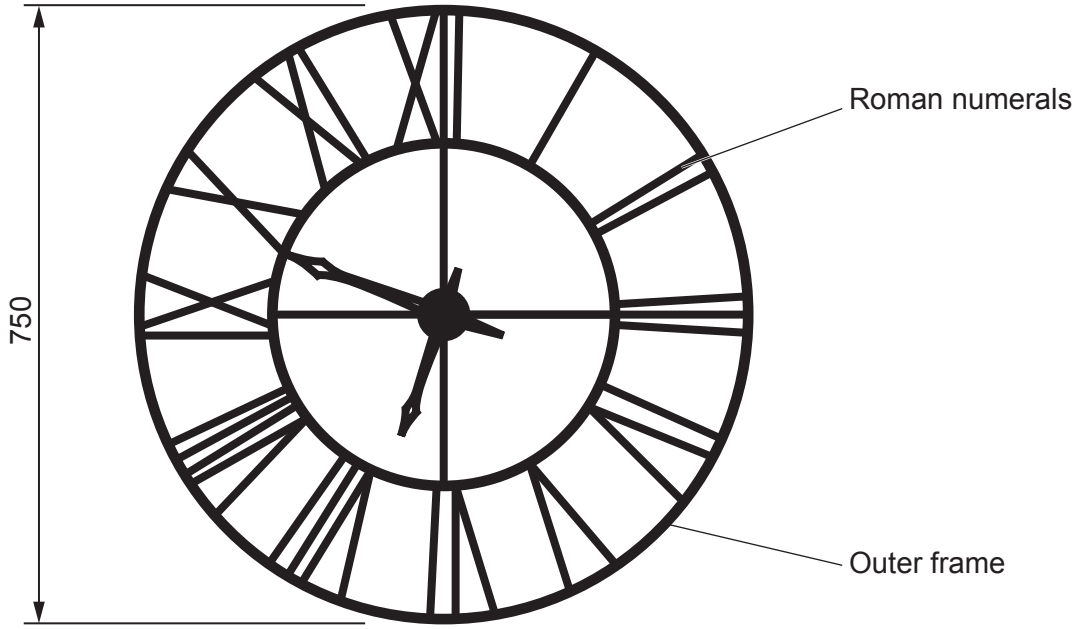
..... **[6]**

2 An image of a clock is shown below. The clock is hanging on a wall.



(a) The circular outer frame of the clock is made from mild steel bar. It is a circle of diameter 750 mm.

Use $\pi = 3.142$

(i) Calculate the length of steel bar needed to make the circular outer frame of the clock.

Circumference circle = πd

Length of steel bar ..... mm **[1]**

(ii) Calculate the surface area of the clock.

Give your answer in **cm^2**.

Area = πr^2.

Surface area ..... cm^2 **[2]**

(iii) The manufacturer wants to make a **smaller** version of the clock keeping all proportions the same.

Calculate the diameter of the circular outer frame if a scale of 1:5 is used.

Diameter ..... mm **[1]**

(b) (i) The clock is made from mild steel which is a ferrous metal.

Explain the difference between ferrous and non-ferrous metal.

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

(ii) Identify **one** non-ferrous metal.

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

(c) The roman numerals on the clock are cut from sheet metal.
A template is used to mark out the roman numerals onto the sheet metal.

(i) Give **two** reasons why a template is used.

1 .....

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2 .....

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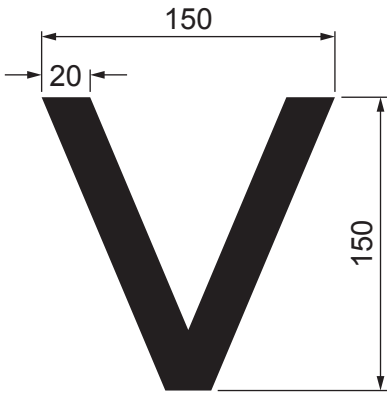
[2]

(ii) Complete the full size drawing, on the grid opposite, of the template for this roman numeral.
The grid points are 1 cm apart. **[3]**



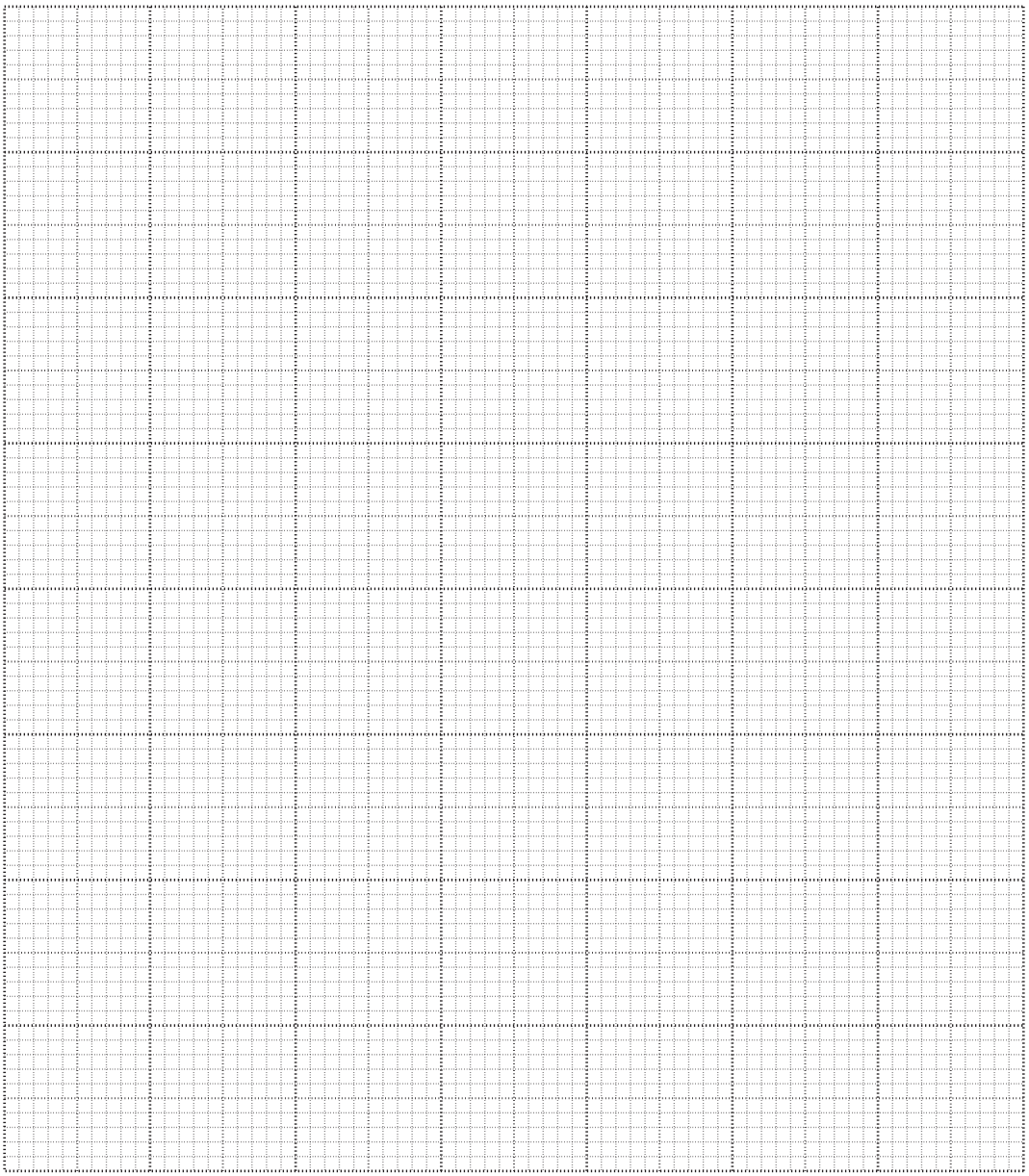
All dimensions in mm.

(d) This table shows sales figures for the clock.

Months	**Number of clocks sold**
January – March	600
April – June	420
July – September	115
October – December	350

(i) Draw a bar chart on the grid below to show these sales figures.

Label both axes.



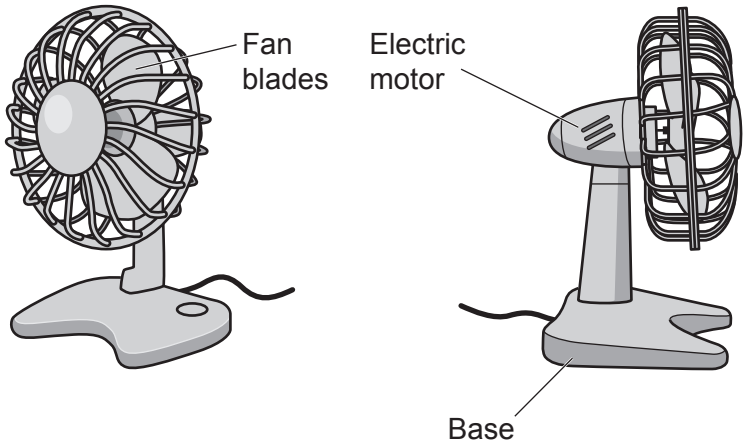
[4]

(ii) Calculate the percentage of sales for January – March.

January – March sales ..... % **[2]**

Turn over for the next question

3 These are images of a desk fan.



(a) The desk fan uses an electric motor.

Describe the function of the electric motor in the fan.

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

(b) The fan blades spin in a circular motion.

Identify this type of motion.

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

(c) The desk fan is powered by mains electricity.

Give **two** benefits of using mains electricity for the desk fan.

1 .....

2 .....

[2]

(d) Electricity can be produced from renewable sources of energy.

Name **two** renewable sources of energy and describe how energy is created from this source.

1 Source .....

Description .....

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2 Source .....

Description .....

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[4]

(e)* Discuss the advantages and disadvantages of the increasing use of renewable energy sources.
Use examples to support your answer. **[8]**

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Turn over for the next question

SECTION B

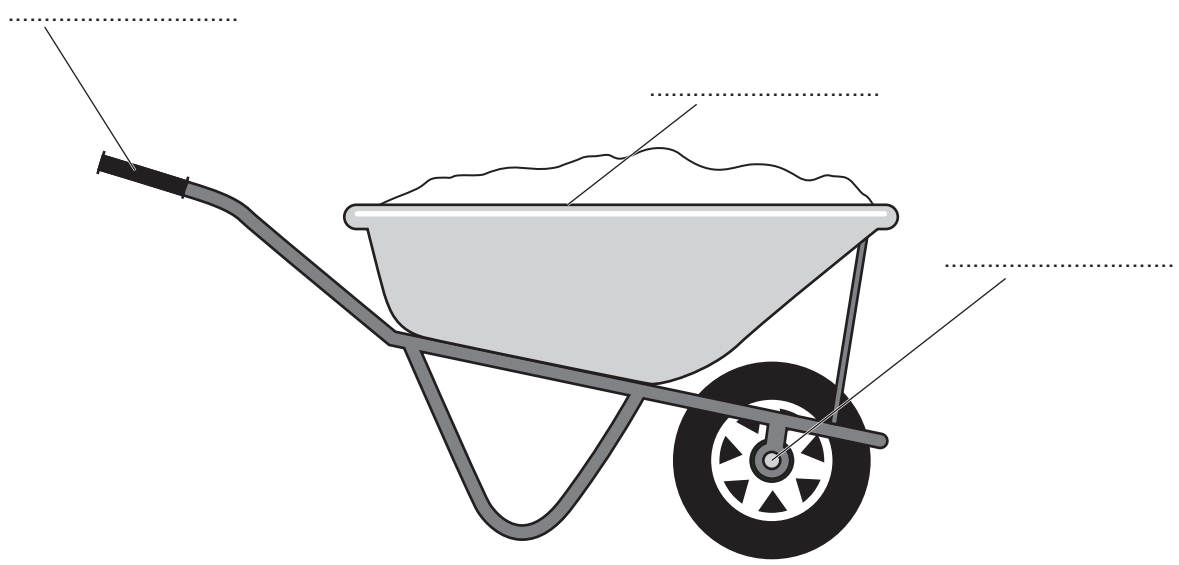
Use the **Insert** to answer **all** the questions in Section B.
The **Insert** has images and information about products used in the garden.

4 Refer to **page 8** of the Insert.

(a) **Image A** shows a wheelbarrow being used in the garden.

A wheelbarrow uses a lever mechanism.

Complete the labels on the diagram to show the **Effort**, **Fulcrum** and **Load**.



[2]

(b) The garden plant pots in **Image B** are made from polyester resin, which is a thermosetting polymer.

(i) Explain **one** reason why this material is suitable for use in garden plant pots.

.....

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

(ii) Give **one** other example of a thermosetting polymer.

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

(c) The seedling pots shown in **Image C** are made from paper pulp.

(i) Give **one** reason why paper pulp is a good environmental choice.

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

(ii) The label in the seedling pot is made from softwood.

Name **one** softwood.

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

(d) **Images D and E** show examples of upcycled products used in a garden.

(i) Give **two** reasons why upcycling is a growing trend.

1 .....

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2 .....

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[2]

(ii) Explain the difference between upcycling and recycling.

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

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PLEASE DO NOT WRITE ON THIS PAGE

You need to answer questions **5** and **6** about **one** of the products listed below covering an area you have studied in depth.

Information about the products is in the **Insert**.

Before you choose a product, read all parts of questions **5** and **6**.

You **must** tick **one** box below to indicate your chosen product.

☐ **Product 1:** Garden party decorations – (papers and boards)

☐ **Product 2:** Seat cushion pad – (fibres and fabrics)

☐ **Product 3:** Solar powered LED strip light – (design engineering)

☐ **Product 4:** Cube seat – (polymers)

☐ **Product 5:** Watering can – (metals)

☐ **Product 6:** Garden table – (timbers)

5 Study and use the images and information about your chosen product given in the **Insert**.

(a) Produce a step-by-step plan to show the stages that have been used to **commercially manufacture** your chosen product.

These stages should include marking out, wasting, moulding, forming, assembly and finish.

You must include details of:
- materials, tools, moulds and components that would be used
- any digital technology used as appropriate.

You can use sketches and notes to support your answer. **[9]**

(b) Explain **two** methods that could be used to ensure consistency and quality when manufacturing your chosen product.

1 .....

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2 .....

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[4]

(c) Explain how the choice of material and/or surface finish used in your chosen product is suitable for an outdoor garden environment.

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

(d) **(i)** Explain how **one** material and/or surface finish used in your chosen product will impact the environment. Consider all stages of your chosen product's lifecycle. **[6]**

Material and/or surface finish: .....

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(ii) Explain **one** way the design of your chosen product could be modified to reduce its environmental impact.

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

You should use the **same** product you chose for Question 5 to answer this question.

6 **(a)** The marketing of products is important to ensure commercial success.

Describe **two** methods that could be used when marketing your chosen product to consumers.

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[4]

(b)* The designer of your chosen product would have communicated their design concepts to potential clients and stakeholders.

Discuss the techniques that designers use to communicate design concepts.

Use specific examples to support your answer. **[8]**

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END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).