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I declare this is my own work.

# A-level

## DESIGN AND TECHNOLOGY: PRODUCT DESIGN

Paper 2 Designing and Making Principles

Friday 16 June 2023

Morning

Time allowed: 1 hour 30 minutes

### Materials

For this paper you must have:

- normal writing and drawing instruments
- a scientific calculator.

### Instructions

- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- There are 30 marks for **Section A** and 50 marks for **Section B**.

For Examiner's Use	
Question	Mark
1	
2	
3	
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7–8	
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<b>TOTAL</b>	



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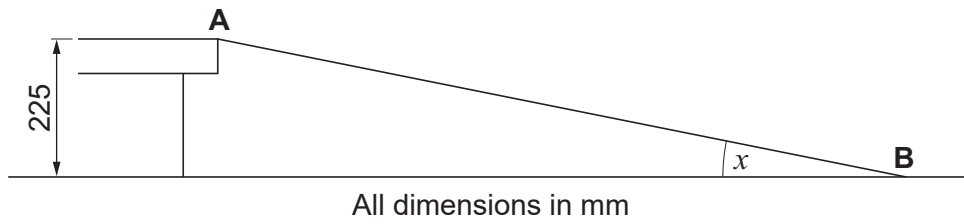
7552/2



0 2

Figure 3 shows a ramp for a wheelbarrow.

Figure 3



The maximum angle ( $x$ ) that a wheelbarrow can be safely pushed up is 20 degrees.

Calculate the length, **AB**, required to allow the wheelbarrow to be safely pushed up the ramp.

Give your answer to the nearest mm.

Show your working.

[4 marks]

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Answer \_\_\_\_\_ mm

4

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0 3

**Table 1** shows the main stages involved in manufacturing a wheelbarrow.

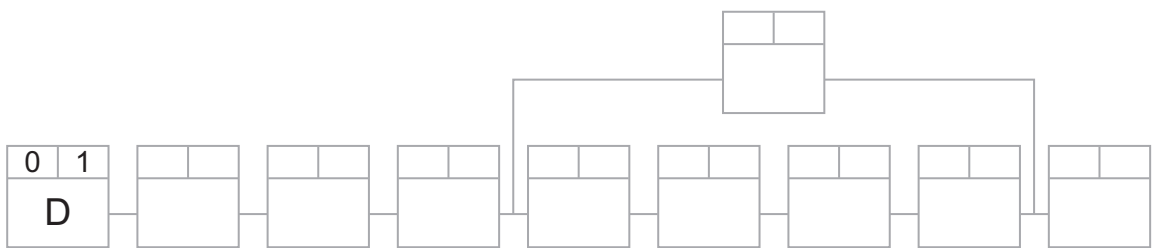
The stages are listed in alphabetical order.

**Table 1**

Stage	Description	Time required (hours)
A	Attach wheel assembly	1
B	Attach wheel support brackets to frame	1
C	Bend tubular steel frame	2
D	Cut stock steel tube to length for tubular steel frame	1
E	Drill bucket using template	1
F	Drill securing holes in tubular steel frame	1
G	Form bucket from steel sheet	2
H	Produce bucket former	3
I	Send bucket for galvanising	6
J	Send frame for powder coating	15

Using the information from **Table 1**, complete the Critical Path Network (CPN) diagram in **Figure 4** to show the correct order for completing the manufacture in the most time-efficient manner.

**Figure 4**



[4 marks]

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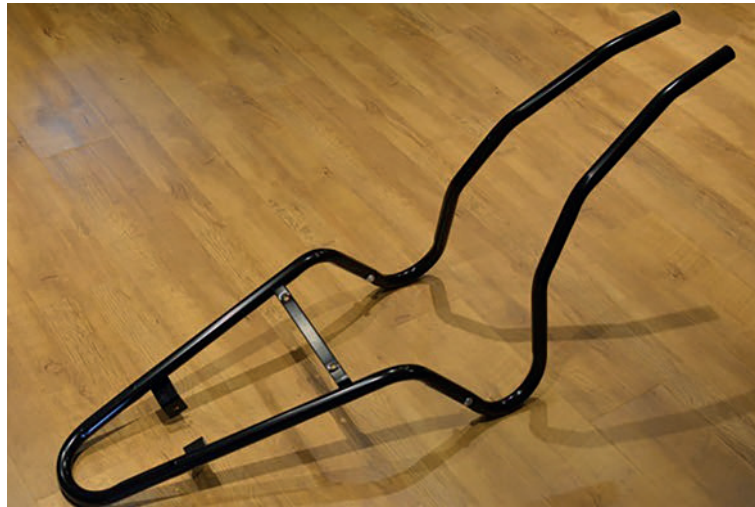
4



0	4
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**Figure 5** shows a powder coated low carbon steel frame for a wheelbarrow.

**Figure 5**



Explain how jigs and templates may have been used to accurately produce multiple copies of the frame shown in **Figure 5**.

**[4 marks]**

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4

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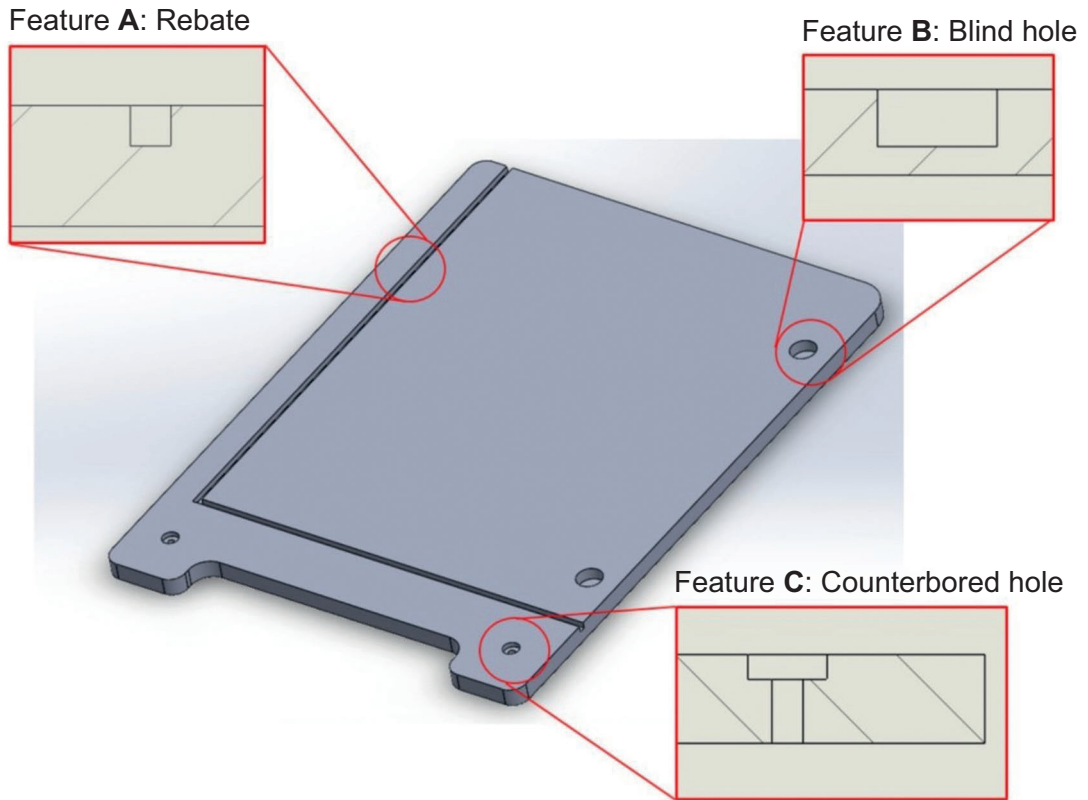


0 5

**Figure 6** shows a CAD model of a component for a piece of flat pack furniture.

The component could be produced on a CNC router or by using wood machine wasting processes.

**Figure 6**



Compare and evaluate **both** manufacturing methods for the three features labelled. **[6 marks]**

Feature A \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



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Feature B \_\_\_\_\_

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Feature C \_\_\_\_\_

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6

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0 6

Figures 7 and 8 show two welding masks.

**Figure 7 Hand held mask**



**Figure 8 Head mounted mask**



	<b>Figure 7</b>	<b>Figure 8</b>
Method of use	Held to face with hand	Mounted over head with adjustable strap
Screen	Translucent green polymer	Light-reactive SMART material







**Section B – Commercial Manufacture**

Answer **all** questions in this section.

**0 7**

Outline how designers make use of market research strategies when developing design concepts.

**[4 marks]**

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**0 8**

State **four** safety precautions to be taken by the user when turning a wooden bowl on a wood lathe.

**[4 marks]**

1 \_\_\_\_\_

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2 \_\_\_\_\_

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3 \_\_\_\_\_

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4 \_\_\_\_\_

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**8**





1 1

Figures 9, 10 and 11 show three coffee cups.

Figure 9



Figure 10



Figure 11



	Figure 9 Disposable coffee cup	Figure 10 Reusable thermoplastic cup	Figure 11 Reusable stainless steel cup
Cup material	Laminated card	Polypropylene (PP)	Stainless steel
Cup production method	Die cutting and fabrication	Polymer forming techniques	Metal forming techniques
Lid material	High Impact Polystyrene (HIPS)	Silicone	Transparent thermoplastic with rubber seal
Lid production method	Vacuum forming	Injection moulding	Injection moulding
Insulation sleeve material	Corrugated cardboard	Silicone	No sleeve

Analyse and evaluate the **environmental impact** of all **three** cups.

In your answer you should refer to:

- raw materials
- product manufacture
- disposal.

[12 marks]

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1	2
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Describe **three** key characteristics of an effective design specification.**[3 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

3 \_\_\_\_\_

\_\_\_\_\_

15



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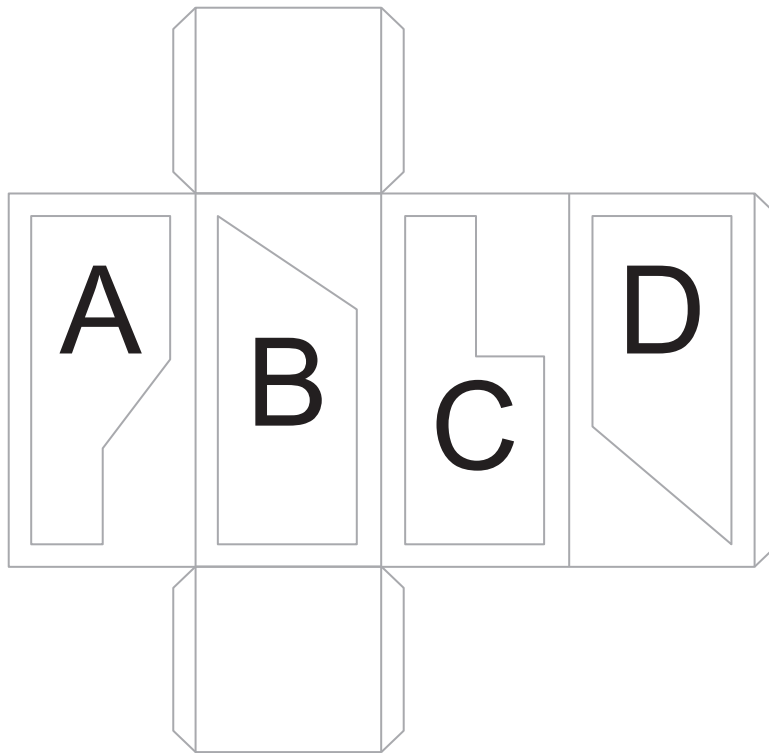
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1 3 . 1 Figure 12 shows a packaging net.

Figure 12



The digital printing process means areas **A**, **B**, **C** and **D** can have a range of different designs applied independently.

**Area A:** Five different designs

**Area B:** Seven different designs

**Area C:** Five different designs

**Area D:** Two different designs

Calculate the number of different design combinations possible.

Show your working.

[2 marks]

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Answer \_\_\_\_\_





**1 3 . 2** A customer is collecting copies of each different package design and needs three more to complete the set.

Assume the design of **Area B** is known.

Calculate the probability that the package they receive will be one of the specific design combinations they require.

Show your working.

**[2 marks]**

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Answer \_\_\_\_\_

**1 4** Name **two** specific measuring devices that can be used to ensure components conform to acceptable tolerances.

**[2 marks]**

1 \_\_\_\_\_  
\_\_\_\_\_

2 \_\_\_\_\_  
\_\_\_\_\_

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1	5
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Figure 13 shows a carbonated drinks bottle.

Figure 13



Identify and explain **three** specific dimensional quality control checks needed to ensure the carbonated drinks bottle can be filled and sealed correctly.

[6 marks]

1 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3 \_\_\_\_\_  
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6
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**1 6 . 1** Define the terms 'ergonomics' and 'anthropometrics'.

**[2 marks]**

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**1 6 . 2** State **one** way that a product with good ergonomics can benefit the product user.

**[1 mark]**

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**3**

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1 7

Figures 14 and 15 show two products designed by Dieter Rams.

Figure 14



Figure 15



Describe how the products shown in **Figures 14** and **15** conform to the principles of modernist design.

[3 marks]

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3

END OF QUESTIONS



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