



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

A-level

DESIGN AND TECHNOLOGY: PRODUCT DESIGN

Paper 1 Technical Principles

Friday 5 June 2020

Morning

Time allowed: 2 hours 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 120.

For Examiner's Use	
Question	Mark
1–4	
5	
6	
7	
8	
9–10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21–22	
TOTAL	



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Answer **all** questions in the spaces provided.

0	1
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Give **three** reasons why polymorph may be used in the modelling of an ergonomic grip.

[3 marks]

1 _____

2 _____

3 _____

0	2
---	---

Define the following material properties:

- malleability
- elasticity.

[2 marks]

Malleability _____

Elasticity _____



0 3

State **three** ways that manufacturers are improving sustainability throughout product manufacture.

[3 marks]

1 _____

2 _____

3 _____

0 4

Explain why high speed steel would be a suitable material for a metal drill bit.

[6 marks]

14

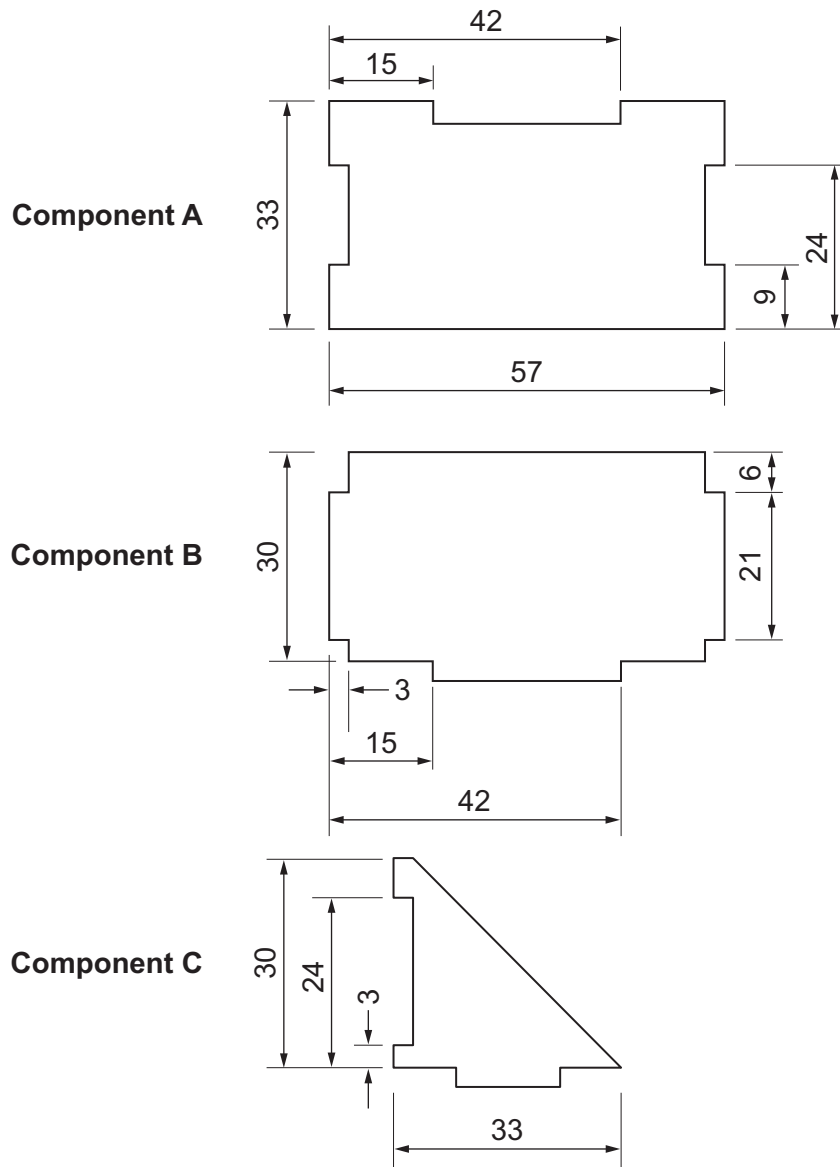
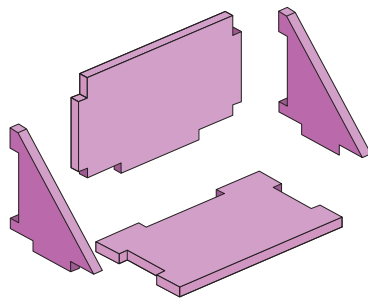
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0 5

Figure 1

Not drawn to scale. All dimensions in mm.

**Figure 2****Fabricated Acrylic component**

0 5 . 1 **Figure 1** shows the dimensions of the components required to produce **Figure 2**.

The component parts are cut from a 90 mm × 70 mm × 3 mm sheet of acrylic.

Calculate the percentage (%) of waste from the acrylic sheet.

Show your working.

[4 marks]

Percentage (%) of waste = _____

Question 5 continues on the next page

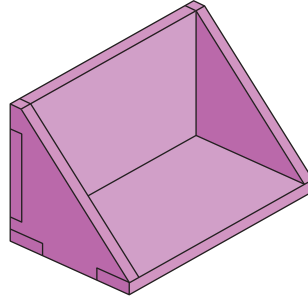
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0 5 . **2**

The product shown in **Figure 3** has been laser cut and fabricated. An alternative method is to form it in one piece using injection moulding.

Figure 3



Compare and evaluate the suitability of each manufacturing method for this product.

[6 marks]

10



0	6
---	---

Describe the main stages in the process of soft soldering.

[6 marks]

6

Turn over for the next question

Turn over ►



0	7
---	---

Explain how the data gained from Electronic Point Of Sale (EPOS) systems can be used.

[6 marks]

6



0 8

Figure 4



Silicone oven mitt

Explain why silicone is an appropriate material for the manufacture of the oven mitt shown in **Figure 4**.

[6 marks]

6

Turn over for the next question

Turn over ►



0 **9**

Analyse and evaluate the suitability of phosphorescent pigment for use in indoor emergency signage.

[6 marks]



1	0
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Describe the purpose of risk assessment in a manufacturing environment.

[6 marks]

12

Turn over for the next question

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1	1
---	---

Figure 5



Concrete table tennis table

Explain why concrete is a suitable material for the manufacture of the outdoor table tennis table shown in **Figure 5**.

[6 marks]

6



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1 2 . 1

Table 1 shows information on the number of pledges and funds raised by a crowd-funding campaign for a new product.

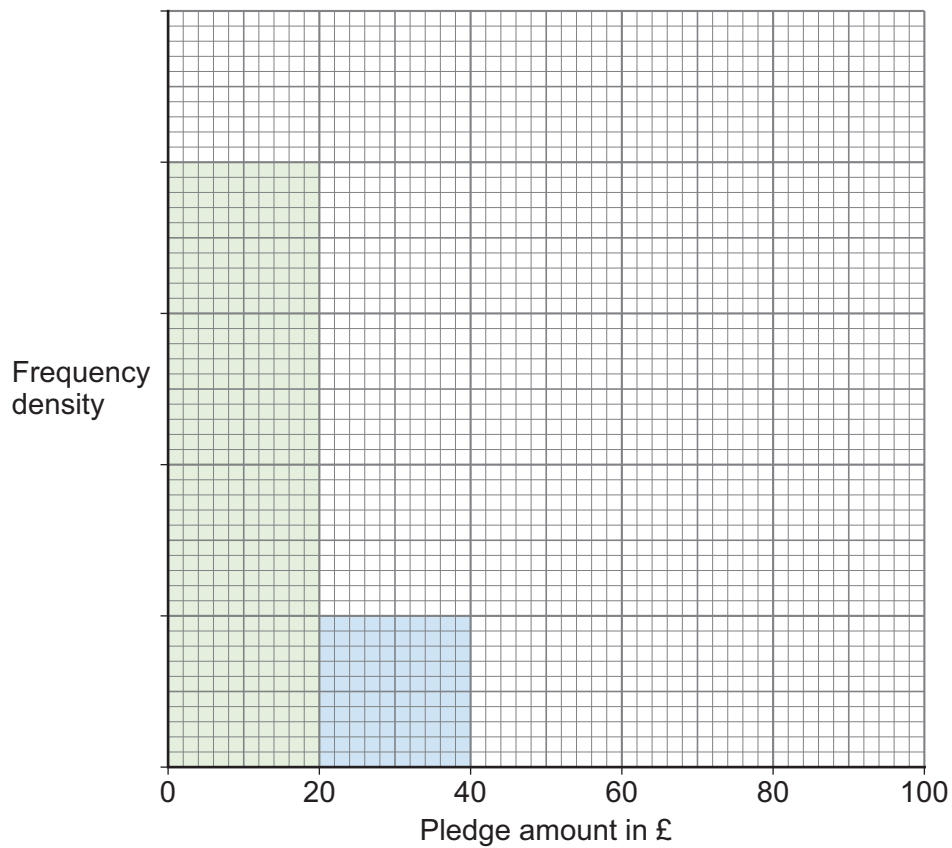
Using the data provided in **Table 1**, complete the histogram in **Figure 6**.

[4 marks]

Table 1

Backer's pledge (£p)	Number of backers
$0 < x \leq 20$	
$20 < x \leq 40$	20
$40 < x \leq 60$	16
$60 < x \leq 100$	20

Figure 6



1 2 . 2

Calculate the percentage (%) of people who supported the campaign with a pledge of £20 or less.

[2 marks]

Percentage (%) of people = _____

6

1 3

Explain why bio-batch may be added to a polymer used in the manufacture of single-use carrier bags.

[2 marks]

2

1 4

State **two** reasons why Danish oil is used as a surface finish for timber.

[2 marks]

1 _____

2 _____

2

Turn over ►



1	5
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Describe how physical and virtual prototypes can be used during the development of a product.

Include the benefits of each kind of prototype to the designer in your answer.

[9 marks]

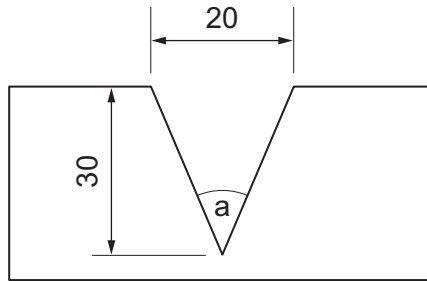
9



1 6

A student wishes to route a symmetrical V-shaped channel in a piece of timber to the dimensions provided in **Figure 7**.

Figure 7



Not drawn to scale

Cross section of timber

All dimensions in mm

Calculate cutter angle a .

Show your working.

[4 marks]

Cutter angle = _____ degrees

4

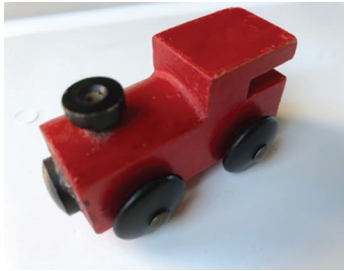
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1	7
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Figure 8 and **Figure 9** show children's toys.

Figure 8



**Beech toy
(hand shaped)**

Figure 9



**Acrylonitrile Butadiene
Styrene (ABS) toy
(injection moulded)**

Analyse and evaluate the suitability of the materials and manufacturing methods used for each of the children's toys.

[12 marks]

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12

1	8
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Explain why polypropylene (PP) is an appropriate material for the manufacture of an ice cream container.

[6 marks]

6

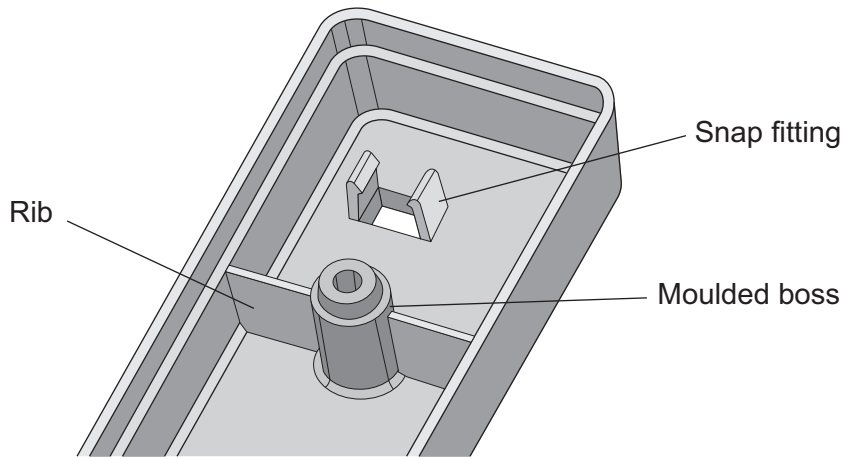
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1 9

Figure 10 shows the internal view of an injection moulded component.

Figure 10



State the function of each of the labelled features.

[3 marks]

Moulded boss _____

Rib _____

Snap fitting _____

3



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2 1

2 0

Figure 11 shows a chocolate bar packaging. **Figure 12** shows a larger mathematically similar promotional version.

Figure 11



Not drawn to scale
All dimensions in mm

Figure 12



Not drawn to scale
All dimensions in mm



Use the information on the diagrams to calculate the percentage (%) increase in volume of the new promotional packaging in **Figure 12**, from the original packaging in **Figure 11**.

[6 marks]

Percentage (%) increase in volume = _____

6

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2 1

Compare and contrast the suitability of producing vehicle signage using either a digital printed image or plotter cut vinyl.

[6 marks]



2	2
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Explain why foam board is a suitable material for the manufacture of an architectural model.

[4 marks]

10

END OF QUESTIONS



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