

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

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
1–2	
3–4	
5	
6	
7	
8–9	
10–11	
12–13	
14–15	
16	
17	
18	
19–20	
21–22	
TOTAL	



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

0 1

State **three** reasons why Precious Metal Clay (PMC) may be used in the manufacture of a decorative pendant for a necklace.

[3 marks]

Reason 1 _____

Reason 2 _____

Reason 3 _____

0 2

A purple component is to be produced using a pigmented resin.

Use the data to calculate the maximum number of these components that could be produced.

You may assume unlimited supplies of clear resin and magenta pigment.

[4 marks]

Cyan pigment available	10 ml
Single component volume	5965 mm ³

	Clear Resin	Cyan Pigment	Magenta Pigment
Ratios for Purple Resin	80	4	1

Answer _____ components

7



Figure 1



Analyse and evaluate the suitability of the material and finish used for the shopping basket.

[6 marks]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Turn over ►



[9 marks]

[illegible]

Turn over for the next question

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outside the
box*

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ANSWER IN THE SPACES PROVIDED**

Turn over ►



0 5 . 1

Table 1 shows a series of coordinates used by a laser cutter to produce a component.

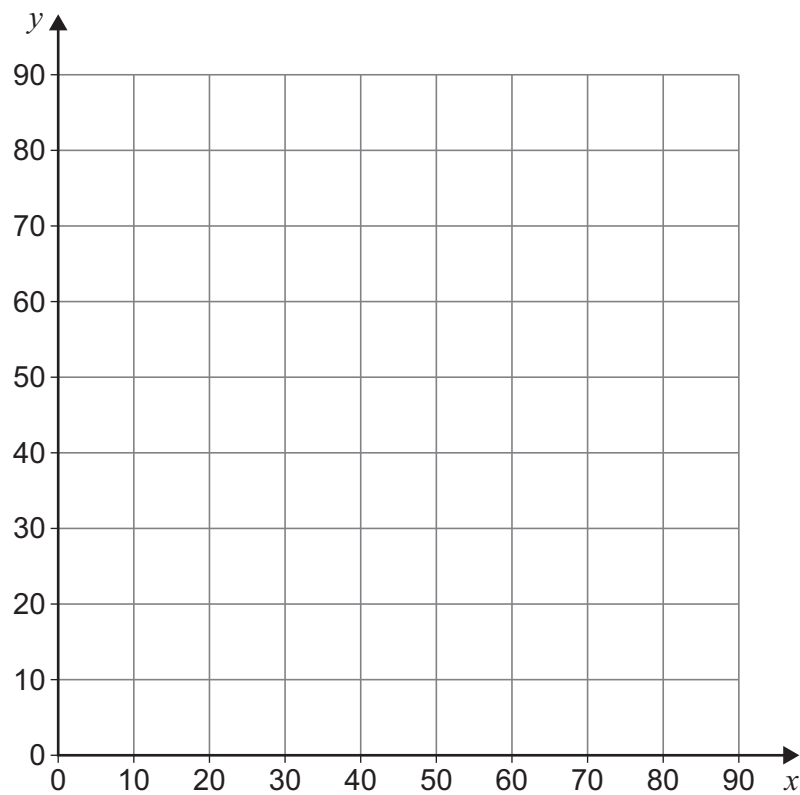
The external and internal cutting paths are shown.

Table 1

External Path	Internal Path
(10,10)	(30,20)
(70,10)	(60,20)
(70,80)	(60,70)
(30,80)	(40,70)
(10,10)	(30,20)

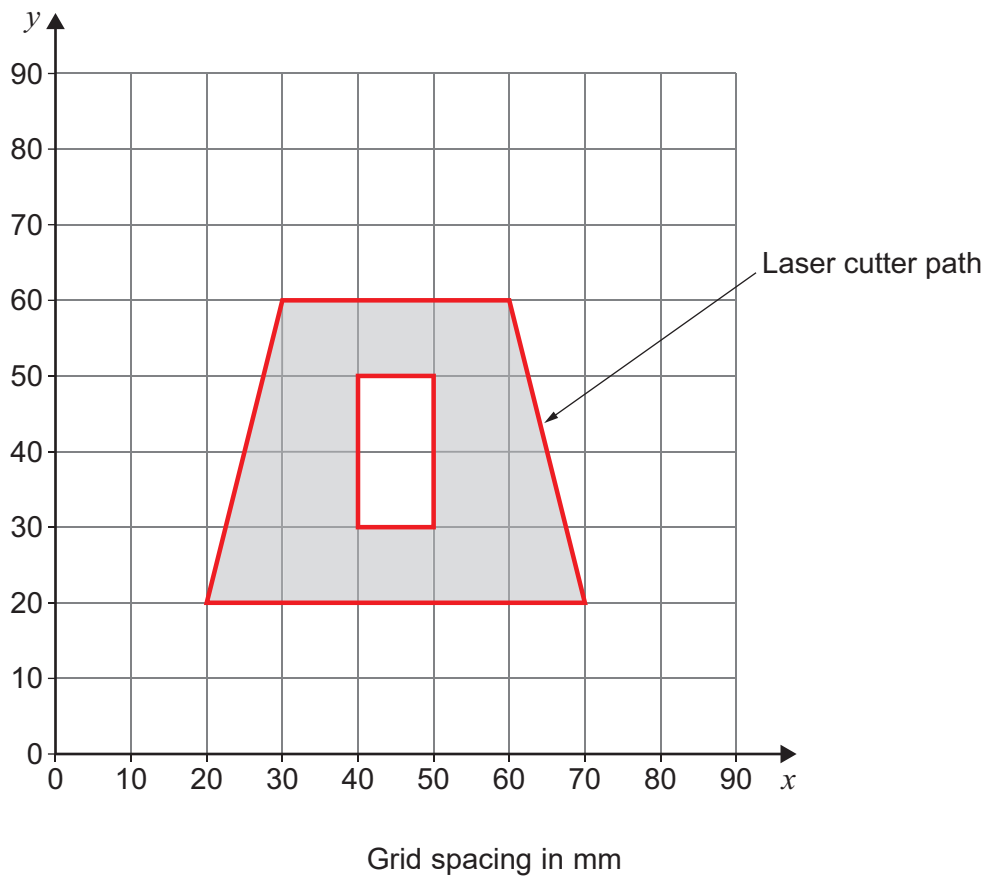
Plot the external and internal paths on the grid below.

[1 mark]



0 5 . 2 Figure 2 shows the path of a laser cutter used to cut the shape below.

Figure 2



Calculate the shaded area.

[2 marks]

Total shaded area _____ mm²

3

Turn over ►



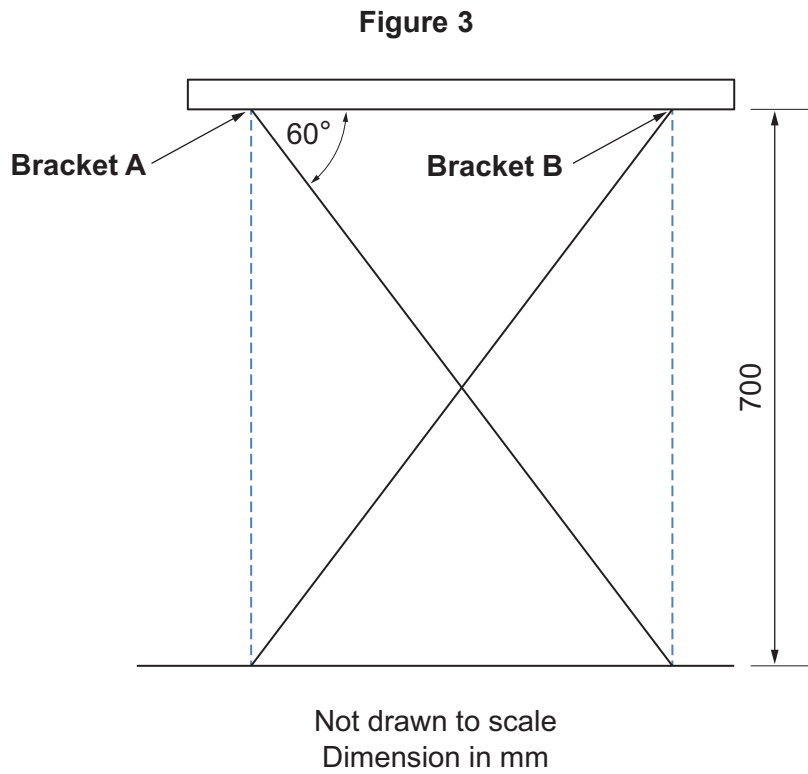
0 6

Figure 3 shows the current dimensions of a school desk.

If all existing components are used, calculate how much closer together **Bracket A** and **Bracket B** would be at a new desk height of 720 mm.

Assume that when fully extended the end of each leg is vertically in line with the bracket on the underside of the desk.

[7 marks]





This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper is oriented vertically.

_____ mm

7



[6 marks]

[illegible]

0 8

State **three** different stimuli that can cause a change in the property of a smart material.

[3 marks]

Stimulus 1 _____

Stimulus 2 _____

Stimulus 3 _____

0 9

Name a specific application for each of the following materials:

[3 marks]

Cellulose acetate _____

Fluted polypropylene _____

Styrofoam _____

6

Turn over for the next question

Turn over ►



Compare and evaluate the suitability of each material for the manufacture of a block model that represents aesthetic appearance to a potential client.

[illegible]

[6 marks]

A detailed model of a Volkswagen Type 2 (Vanagon) in a two-tone blue and white color scheme, shown from a front-three-quarter view. The model features a white upper body and a dark blue lower body, with a white roof and a blue front grille. The Volkswagen logo is visible on the front grille. The model is shown from a front-three-quarter view, highlighting its boxy design and large windows. The license plate area displays the text "VOLKSWAGEN".

[illegible]

Turn over ►



1	2
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Describe the purpose of the following polymer additives:

- fillers
- plasticisers.

[2 x 2 marks]

Fillers _____

Plasticisers _____

1	3
---	---

Give **two** reasons why outdoor decking may be pressure treated before use.

[2 marks]

1 _____

2 _____

6



[6 marks]

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface. There is no handwriting or other markings on the paper.

[6 marks]

[illegible]

12



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ANSWER IN THE SPACES PROVIDED**

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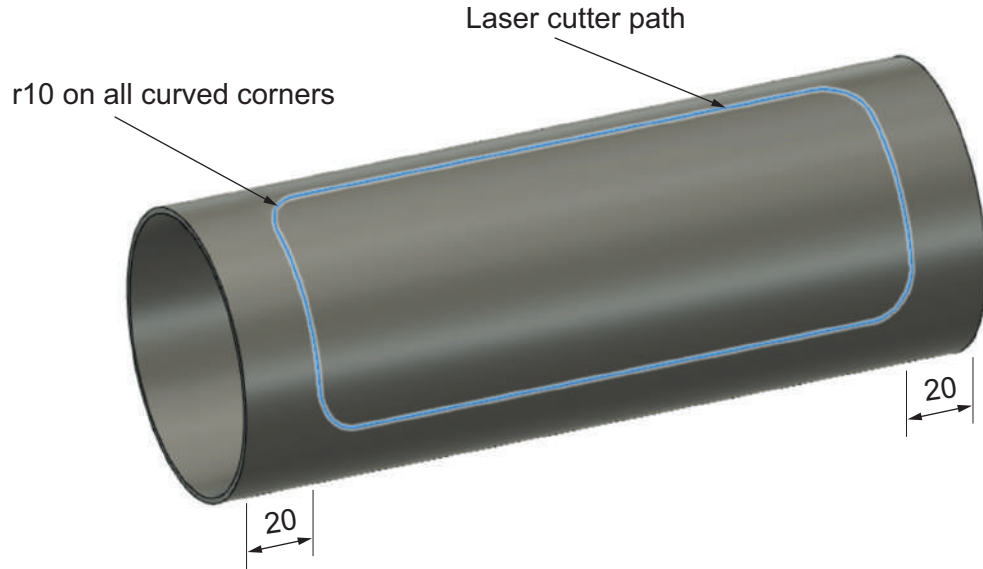


1 6

Figure 7 shows an acrylic tube that will have a section cut out on a laser cutter.

The section to be removed is **one quarter** of the circumference of the tube.

Figure 7



All dimensions in mm

Length of Cylinder	200 mm
Diameter of Cylinder	75 mm
Cutting Speed	2200 mm per minute

Use the data provided to calculate the time taken to cut the path shown on the acrylic tube.

[6 marks]



Total time taken in seconds _____

6

Turn over for the next question**Turn over ►**

Figure 8 and **Figure 9** show two novelty moneyboxes, each with a slot for coins located at the top.

Figure 9



**Injection moulded,
polymethylmethacrylate (PMMA)
moneybox**

[12 marks]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]

12



[6 marks]

[illegible]

6



1	9
---	---

Describe **two** ways that a jig can be used to improve accuracy in manufacture.

[2 x 2 marks]

1 _____

2 _____

Turn over for the next question

Turn over ►



[6 marks]

[illegible]

10



[6 marks]

[illegible]

[6 marks]

[illegible]

12

END OF QUESTIONS



There are no questions printed on this page

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[illegible]

[illegible]

[illegible]

[illegible]

