AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

A-level
DESIGN AND TECHNOLOGY: PRODUCT DESIGN

Paper 1 Technical Principles

Friday 7 June 2019 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.
- 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	
Pages	Mark
2–3	
4–5	
6–8	
9	
10–11	
12	
13–15	
16–17	
18–19	
20–21	
22	
TOTAL	

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

Do not write outside the box

0 1 Explain why 'potatopak' is a suitable material for the manufacture of disposable cutlery.
[3 marks]

0 2 Explain how BSI certification impacts on the purchase of a child's car seat by a consumer.
[6 marks]

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0 3 Give **three** benefits of using stock forms of material for a manufacturer.

[3 marks]

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

0 4 PAR is a stock form of timber. What does PAR stand for?

[1 mark]

_____

_____

13

Turn over for the next question

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0 5 **Figure 1** shows a children's climbing frame.

Figure 1

Explain why powder coating is an appropriate finish for the climbing frame shown in **Figure 1**.

[6 marks]

Do not write outside the box

0 6 Define each of the following terms:

- copyright
- trademark
- patent.

[3 marks]

Copyright _____

_____

Trademark _____

_____

Patent _____

_____

9

Turn over for the next question

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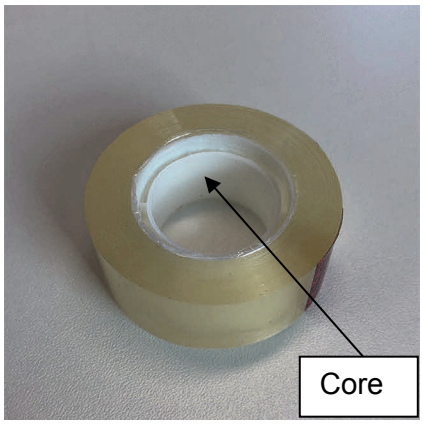
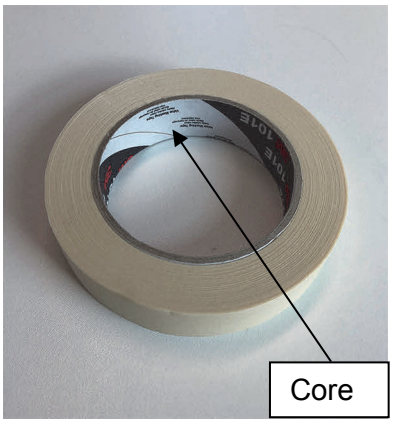
0 7 **Figures 2** and **3** show rolls of adhesive tape.

Figure 2



A roll with an ABS core

Figure 3



A roll with a cardboard core

Compare the environmental impact of the materials used to manufacture the cores of the adhesive tapes shown.

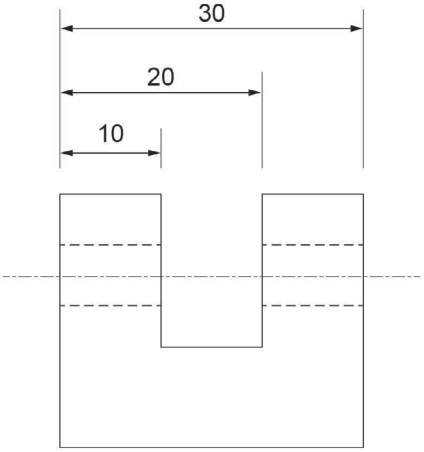
[6 marks]

Do not write outside the box

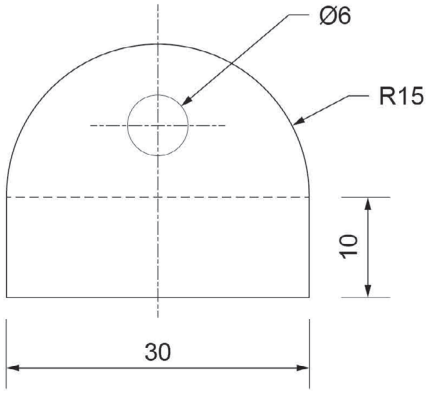
0 8 **Figure 4** shows the dimensions of a component to be made using 3D printing.

Figure 4
All dimensions in mm
Not drawn to scale

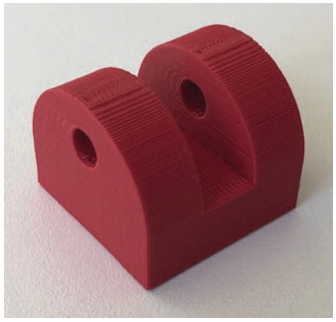
Front view



Side view



Completed component



	Material costs	
Material	**Printed density (grams per mm^3)**	**Cost per 500 g**
ABS	0.000 448 g	£18

Calculate the material cost of manufacturing 50 units.

Show your working out.

[5 marks]

Turn over ►

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0 9 Name a specific application for each of the following compliant materials:

- bleed proof paper
- duplex card
- moulded paper pulp.

[3 marks]

Bleed proof paper

Duplex card

Moulded paper pulp

14

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1 0 Evaluate the following techniques for rendering a design:

- using computer aided design (CAD)
- hand generated.

[6 marks]

6

Turn over for the next question

Do not write outside the box

1 1 **Figure 5** shows an aluminium seat clamp. **Figure 6** shows the dimensions of a block of aluminium.

Figure 5

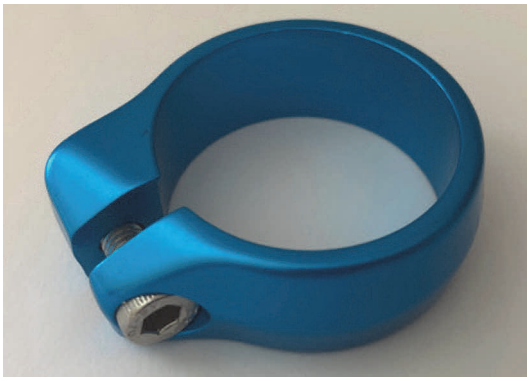
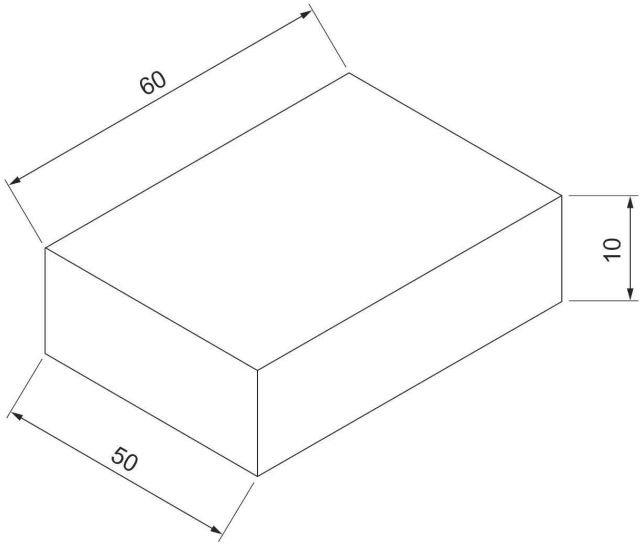


Figure 6
All dimensions in mm
Not drawn to scale



The seat clamp is currently manufactured by wastage from the aluminium block shown in **Figure 6**.

The manufacturer wants to produce the clamp using a redistribution process.

Compare the cost of each manufacturing process if 5000 units are to be produced.

Show your working out.

Volume of the seat clamp	7280 mm^3
Cost of aluminium	£4 per 100 000 mm^3
Cost of manufacturing a mould for the redistribution process	£3000

[6 marks]

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1 2 Explain the safe work practices necessary to protect workers when using solvent adhesives.

[6 marks]

12

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1 3 Explain why neoprene is a suitable material to manufacture a case to carry a laptop.

[8 marks]

8

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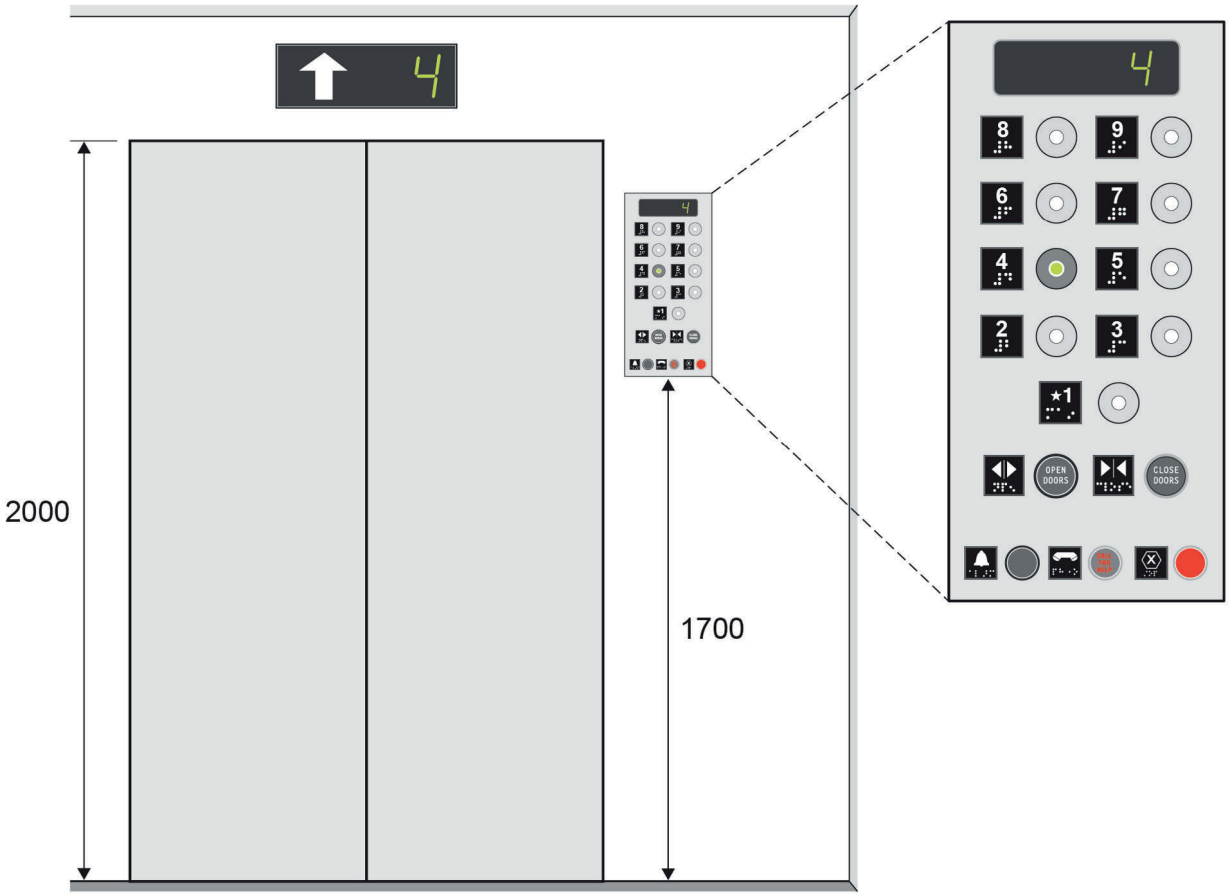
1 4 **Figure 7** shows a lift interface.

Figure 7
All dimensions in mm
Not drawn to scale



Evaluate how well the lift interface has been designed to be inclusive to all users.

[6 marks]

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1 5 A manufacturer is producing a glass reinforced plastic (GRP) moulding.

Calculate the volume of hardener needed.

Show all of your working.

Size of GRP mat needed for moulding	2 metres × 5 metres
Ratio of resin to hardener	3 : 2
Total volume of liquid (resin and hardener) needed per m^2 of GRP matting	3 litres per m^2

[4 marks]

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1 6 Explain why industrial tests are more accurate than workshop tests when testing material properties.

[2 marks]

1 7 Describe how a specific industrial test is undertaken to measure material hardness.

[4 marks]

16

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1 8 **Figure 8** and **Figure 9** show two bicycle frames.

Figure 8

Aluminium TIG welded bicycle frame

Figure 9

CFRP lay-up bicycle frame

Evaluate the suitability of the materials and manufacturing methods used for each of the bicycle frames shown.

[12 marks]

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12

Turn over for the next question

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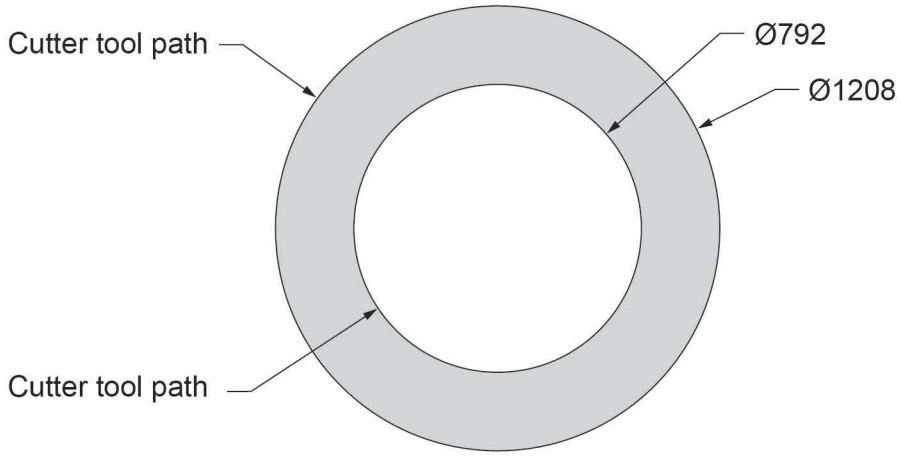
1 9 **Figure 10** shows a component to be cut on a computer numerically controlled (CNC) router.

Figure 10
All dimensions in mm
Not drawn to scale



Material	Depth of cut per pass	Rate of cut
12 mm MDF	6 mm	6 metres per minute
12 mm plywood	4 mm	4.5 metres per minute

Calculate how long it would take to machine the shape in each of the materials.

Show your working out.

[6 marks]

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6

Turn over for the next question

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2 0 **Figures 11**, **12** and **13** show pieces of self-assembly furniture.

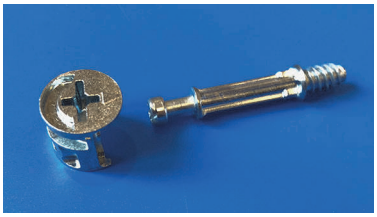
Figure 11

Cot frame using barrel nuts and bolts

Barrel nut and bolt

Figure 12

Shelf unit frame using cam locks



Cam lock

Figure 13

Bookcase shelf using dowels

Dowel

Explain why the knock down fittings named above are appropriate for each of the specific applications.

[3 × 2 marks]

Barrel nut and bolt _____

_____

_____

_____

Cam lock _____

_____

_____

_____

Dowel _____

_____

_____

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2 1 Explain the importance of the efficient supply of materials and components in a Just In Time (JIT) manufacturing process.

[9 marks]

15

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2 2 Give **three** reasons why a kitchen work surface may have a melamine formaldehyde layer applied.

[3 marks]

Reason 1 _____

Reason 2 _____

Reason 3 _____

2 3 Describe the process of forming a timber product using lamination.

[6 marks]

END OF QUESTIONS

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