Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

C600U10-1

Z22-C600U10-1

WEDNESDAY, 15 JUNE 2022 – AFTERNOON

DESIGN AND TECHNOLOGY

Component 1
DESIGN AND TECHNOLOGY IN THE 21st CENTURY

2 hours

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**10**	
	2.	**10**	
	3.	**15**	
	4.	**20**	
	5.	**20**	
Section B	**6.**	**25**	
	Total	**100**	

C600U101
01

ADDITIONAL MATERIALS

You will need basic drawing equipment, coloured pencils and a calculator for this examination.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid. You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer questions 1 to 5 and **ONLY ONE question 6**.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

Examiner only

SECTION A

Answer **all** questions.

This question is about Design and Technology and our world.

1. (a) The table below shows a household's annual energy consumption.

Energy	kWh	Cost
Electricity	2930	.....
Gas	.....	£639
Total	14975	£1126

(i) Complete the table above by calculating the missing figures. [2]
Show all workings.

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(ii) If the household installed solar panels, they would save a total of £210 per year.
Calculate the saving as a percentage. [2]
Show all workings.

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Examiner only

(b)

(i) State the name of the logo shown above. [1]

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(ii) Explain why this logo is important for ethical production. [3]

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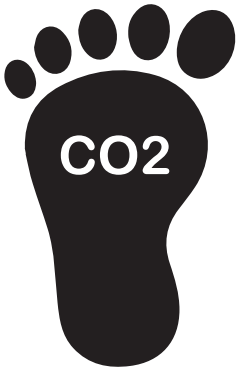
(iii) Describe why this logo appears on product packaging. [2]



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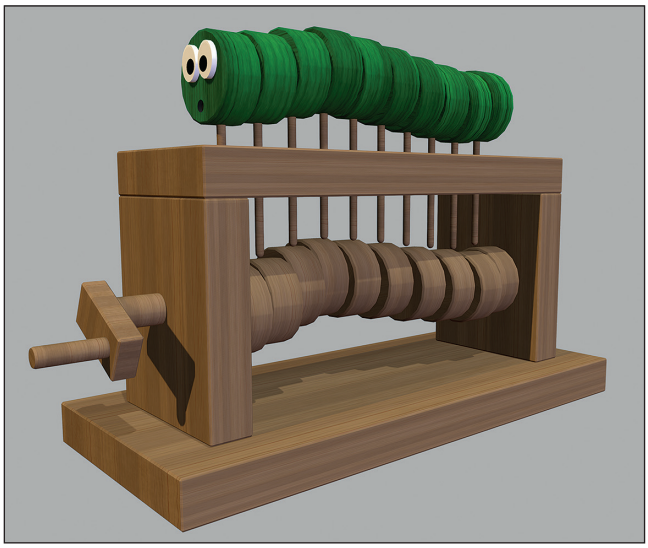
03

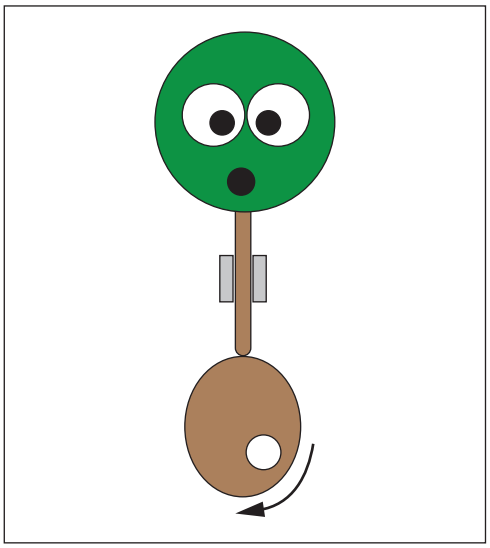
Examiner only

This question is about mechanical devices.

2. (a) The images below show an Automata Toy and its Cam Mechanism.



Automata Toy



Cam Mechanism

(i) State the function of the Cams on the Automata Toy. [1]

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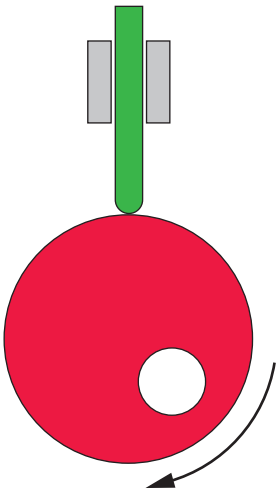
(ii) Draw arrows to correctly identify the Cam and the Follower on the image below. [2]

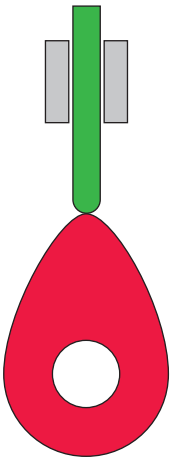
Follower



Cam

Examiner only

(b) The image below shows a pear-shaped Cam. Describe the motion produced by this mechanism. [2]



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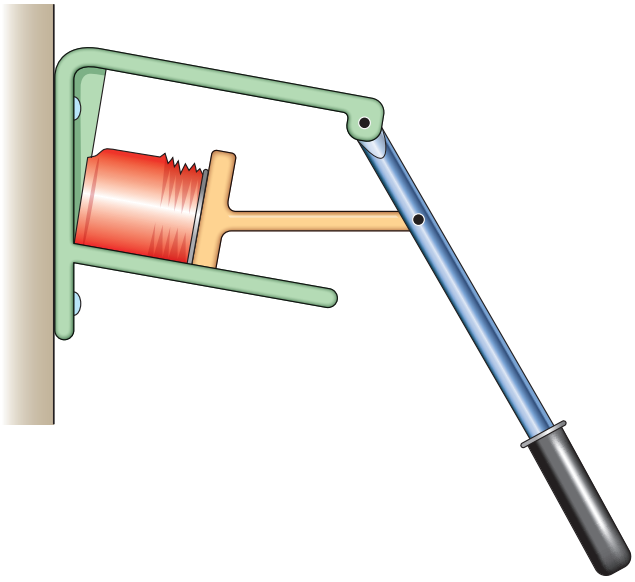
(c) The image below shows a lever system used to crush aluminium cans ready for recycling.

Draw arrows to correctly label the effort and load. [2]



(d) Analyse the environmental benefits of consumers crushing and recycling aluminium cans. [3]

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05

Examiner only

This question is about smart, composite and technical materials.

3. (a) The tent below is made from a range of modern materials.

(i) State the name of an appropriate composite material used to make the tent poles. [1]

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(ii) Describe the properties of the composite material you have stated that make it suitable for its use as a tent pole. [3]

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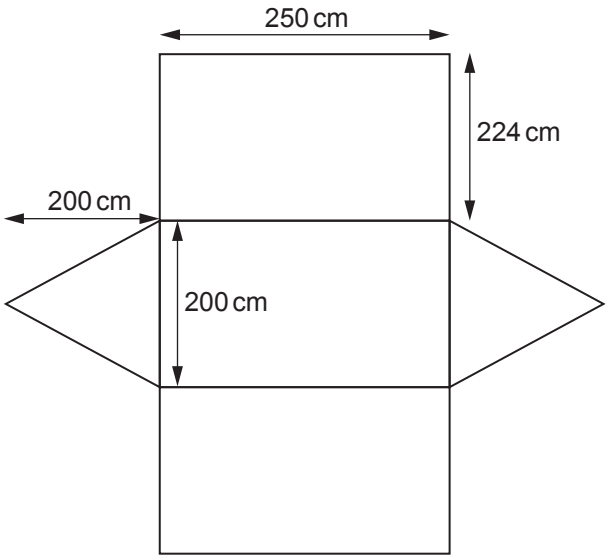
Examiner only

(b) (i) The net of the tent is shown below. Calculate the surface area of the tent. Show all workings. [4]



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07

Examiner only

(ii) The product shown below is a storage bag for the tent. It is made from microfibres.

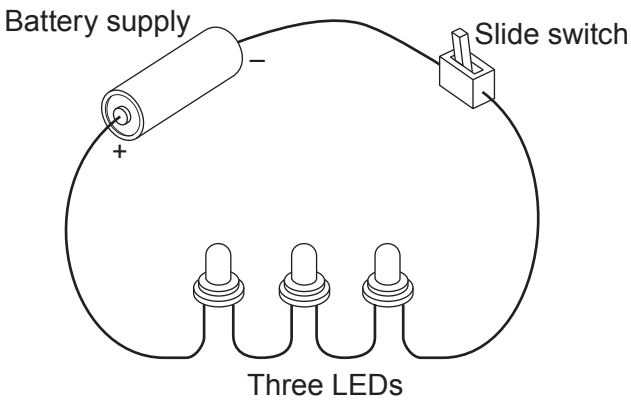
Put a tick (✓) in the grid below to indicate whether the following statements are **true** or **false**. [2]

Statement	True	False
Microfibres can be manufactured from natural and synthetic materials.		
Microfibres have an excellent strength-to-weight ratio.		

Examiner only

(c) The image below shows a head torch used for camping.

Review the sketched diagram below, which is a simplified sketched version of the electrics used to power the light.



Using standard circuit symbols for each component, produce a circuit diagram in the space below. [5]

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09

Examiner only

This question is about materials.

4. (a) Describe the structure of **each** of the manufactured boards shown in the table below.

3 × [2]

Manufactured Board	Name	Description
	Plywood	....
	Chipboard	....
	Medium Density Fibreboard	....

Examiner only

(b) The image below shows a selection of detergent bottles made from a thermoforming plastic.

(i) State the name of the most appropriate thermoforming plastic used to manufacture the bottles. [1]

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(ii) Explain why a thermoforming plastic is suitable for the manufacture of detergent bottles. [3]

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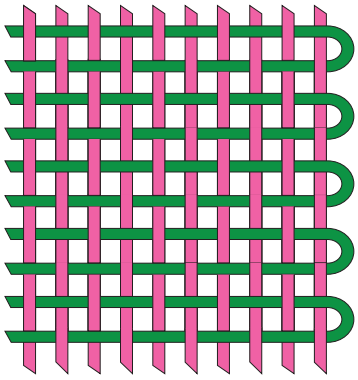
Examiner only

(c) The diagram below is of a fabric construction.



(i) Study the diagram above. Complete the following sentences by inserting the correct words from the list provided. 3 × [1]

Knitted **Woven** **Looped** **Weft** **Warp**

..... fabrics are constructed using interlocking yarns. The yarns that run horizontally are called ..... yarns. The yarns that run vertically down the length of the fabric are called ..... yarns.

(ii) The ties shown in the images below are identical in design but differ in fibre content.

Silk tie

Polyester tie

Discuss the properties of silk and polyester that make them suitable fabrics for the ties. [3]

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Examiner only

(d) Below are pictures of a robot building kit made from recycled paper.

(i) The size of the paper used to make the envelope is 297 mm × 420 mm.

Circle the correct standard size below, used to make the envelope. [1]

A3 A4 A5

(ii) 60% of the card is made from recycled paper. Describe **one** disadvantage of using recycled paper for this product. [3]

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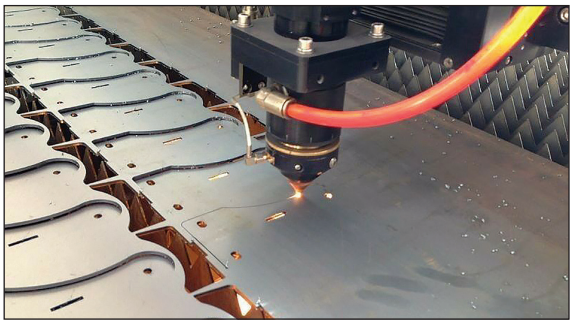
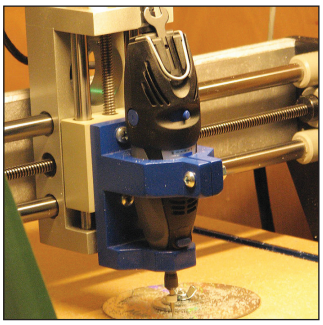
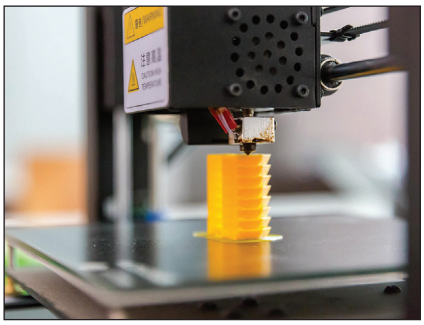
C600U101
13

Examiner only

5. Review the images below and select **one CAM device** when answering the questions (a) to (c). Place a tick (✓) in the box of your selected device.

	
Laser Cutter ☐	CNC Embroidery Machine ☐
	
CNC Router Machine ☐	3D Printer ☐

(a) (i) All the images above are examples of CAM devices.
State the meaning of CAM. [1]

C..... A..... M.....

(ii) Explain the benefits of using your chosen CAM device when making products in school. [3]

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Examiner only

(b) The CAM devices require input from a CAD software package.

(i) Give **one** example of a CAD software package that could be used with your chosen device. [1]

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(ii) Describe **two** disadvantages of using CAD in a school environment. [4]

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C600U101
15

(c) (i) Explain a safety consideration when using your chosen CAM device. [2]

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(ii) Evaluate the use of your chosen CAM device when used in the development of a design. [4]

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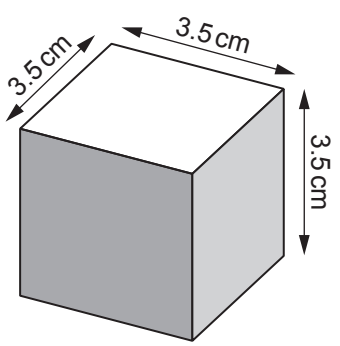
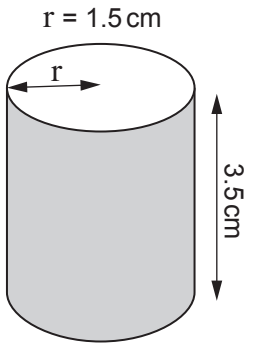
Examiner only

(d) The CAD drawings below show two solid shapes that are to be 3D printed to form part of a child's toy puzzle.





Calculate the volume of the cube and the cylinder shapes.
Round your answer to 2 decimal points. Show all workings.

Volume of cube: [2]

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Answer ..... cm^3

Volume of cylinder: [3]

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Answer ..... cm^3

SECTION B: OPTIONAL QUESTIONS

Choose **ONE topic area only**.

Place a tick (✓) in **one** of the boxes below, to show which topic you are answering.

		Pages
Electronic systems, programmable components and mechanical devices	☐	18–21
Papers and boards	☐	22–25
Natural and manufactured timber	☐	26–29
Ferrous and non-ferrous metals	☐	30–33
Thermosetting and thermoforming plastics	☐	34–37
Fibres and textiles	☐	38–41

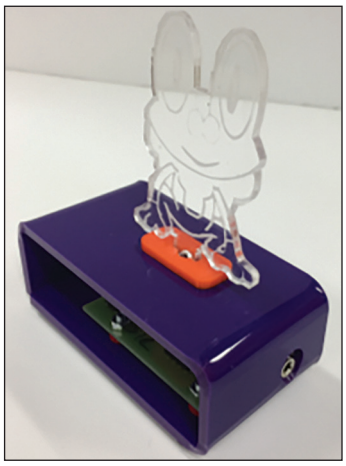
Now answer all parts of your chosen topic.

Examiner only

SECTION B

6. Electronic systems, programmable components and mechanical devices

(a) The pictures below show a child's colour changing mood light.



(i) State the name of a component that could be used to turn on the child's mood light. [1]

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(ii) The circuit board in the child's mood light is designed with a PIC chip. State a function of the PIC chip. [1]

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(iii) Explain why a double-sided circuit board is used in the child's mood light. [2]

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Examiner only

(iv) The image below shows a piece of equipment used to attach the components to the circuit board in the child's mood light.

State the name of this piece of equipment. [1]

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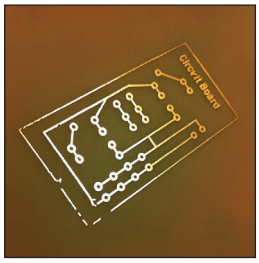
(v) The picture below shows a circuit board. Describe the process of joining the LED onto the circuit board. [4]

	Description of soldering the LED
	....

C600U101
19

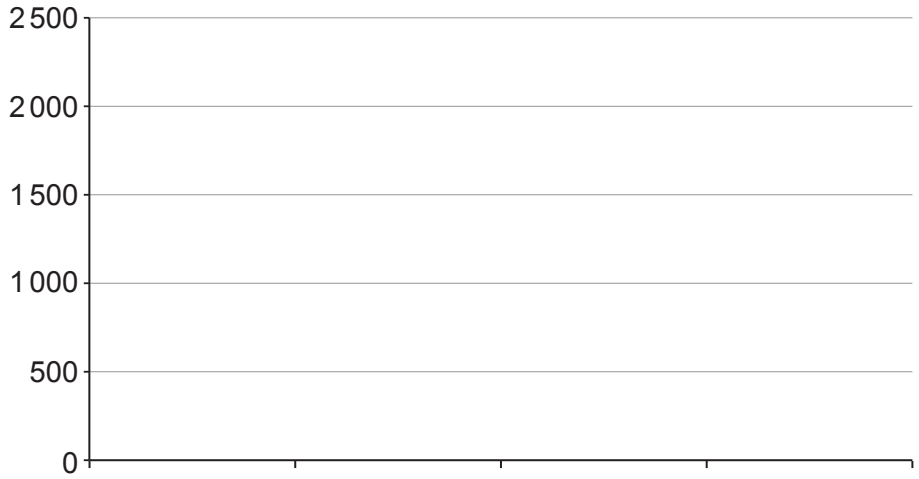
Examiner only

(b) A retailer tracked the sales of the child's mood light over a 4-month period. The table below displays the data collected.

Sales (£)	**Month**
1 500	December
2 500	January
750	February
500	March

(i) In the space below, draw and label a bar chart showing the data found in the table above. [3]

Bar chart of sales



Examiner only

(ii) The retailer pays 20% Value Added Tax (VAT) on all sales over a period of four months. Calculate how much VAT will need to be paid for the child's mood lights over the 4-month period. [2]
Show all workings.

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(c) Different electronic components use a wide range of materials, for example, silver, cadmium, ferric chloride and mercury.

Analyse the impact recycling electronic components has on our ecological footprint. [5]

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(d) Evaluate why prototyping and modelling design ideas benefit both the designer and manufacturer when designing a child's mood light. [6]

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C600U101
21

Examiner only

6. Papers and boards

(a) The pictures below are of greetings cards manufactured from 180 gsm card.

(i) State **one** reason why 180 gsm is the most suitable weight for the greetings cards. [1]

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(ii) State **one** reason why a 'duplex' printer is used to manufacture the greetings cards. [1]

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(iii) Explain why registration marks are used when manufacturing greetings cards. [2]

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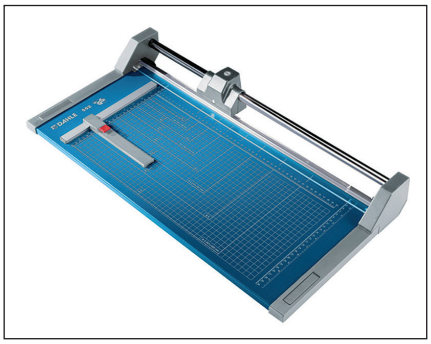
Examiner only

(iv) The picture below shows a piece of equipment used to manufacture the greetings cards.



State the name of this piece of equipment. [1]

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(v) The greetings card has been constructed using a die cutting machine. Describe the process of die cutting the greetings card shown. [4]

Description of die cutting process

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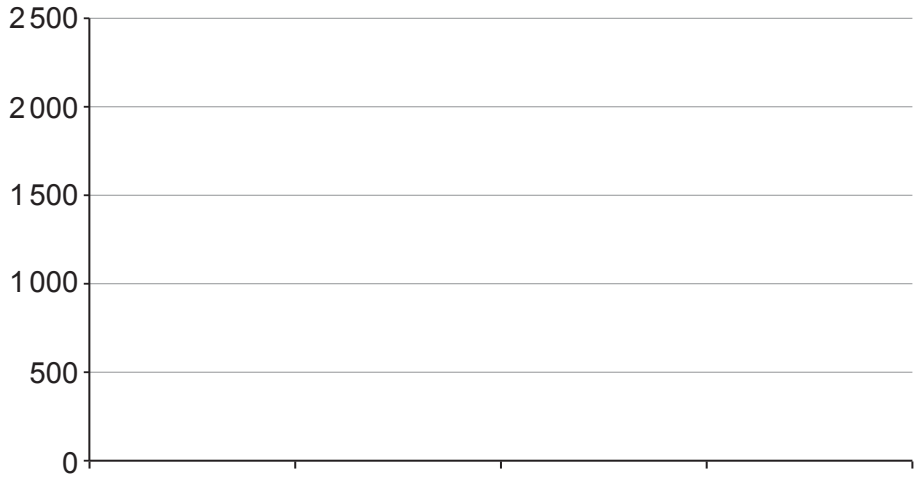
Examiner only

(b) A retailer tracked the sales of the greetings cards over a 4-month period. The table below displays the data collected.

Sales (£)	**Month**
1 500	December
2 500	January
750	February
500	March

(i) In the space below draw and label a bar chart showing the sales data found in the table above. [3]

Bar chart of sales



Examiner only

(ii) The retailer pays 20% Value Added Tax (VAT) on all sales. Calculate how much VAT will need to be paid for the greetings cards sales over the 4-month period. [2] Show all workings.

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(c) Wood and wood pulp are materials used to manufacture the greetings cards.

Analyse the impact harvesting these materials has on our ecological footprint. [5]

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(d) Evaluate why prototyping and modelling design ideas benefit both the designer and the manufacturer when designing a greetings card. [6]

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Examiner only

6. Natural and manufactured timber

(a) The picture below is of a child's toy made from natural timber.

(i) State the name of the component used to join the wheels to the toy. [1]

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(ii) State the name of the machine used to create the animal's eye in the child's toy. [1]

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(iii) The child's toys have different finishes applied. Explain why a finish is used. [2]

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Examiner only

(iv) The image below shows a piece of equipment used to finish parts of the child's toy.

State the name of this piece of equipment. [1]

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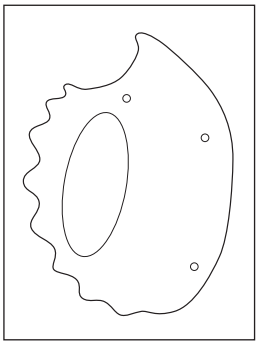
(v) The wooden toy has been constructed using a rectangular timber block. Describe how to manufacture the body of the child's toy. [4]



Description of manufacturing the body of the toy

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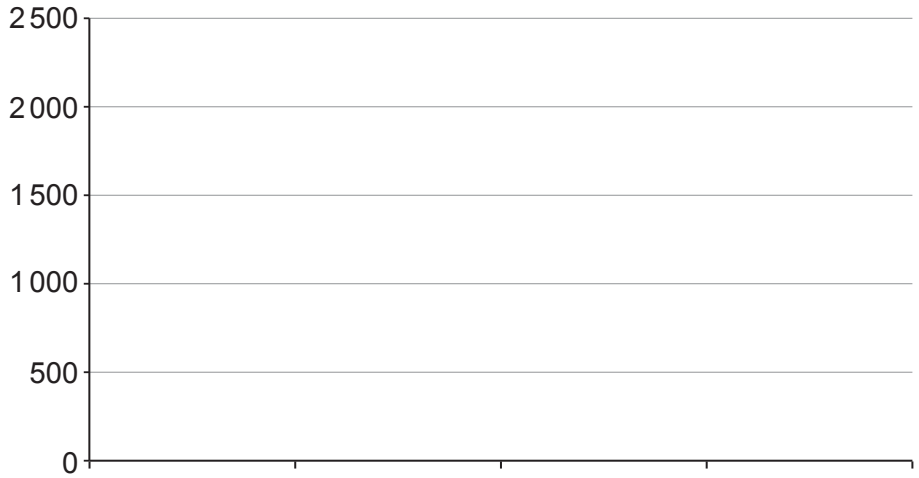
Examiner only

(b) A retailer tracked the sales of the child's toy over a 4-month period. The table below displays the data collected.

Sales (£)	**Month**
1 500	December
2 500	January
750	February
500	March

(i) In the space below draw and label a bar chart showing the sales data found in the table above. [3]

Bar chart of sales



Examiner only

(ii) The retailer pays 20% Value Added Tax (VAT) on all sales. Calculate how much VAT will need to be paid for the child's toy sales over the 4-month period. Show all workings. [2]

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(c) Pine and oak are natural timbers used to manufacture the child's toy.

Analyse the impact deforestation and converting natural timbers has on our ecological footprint. [5]

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(d) Evaluate why prototyping and modelling design ideas benefit both the designer and the manufacturer when designing a child's toy. [6]

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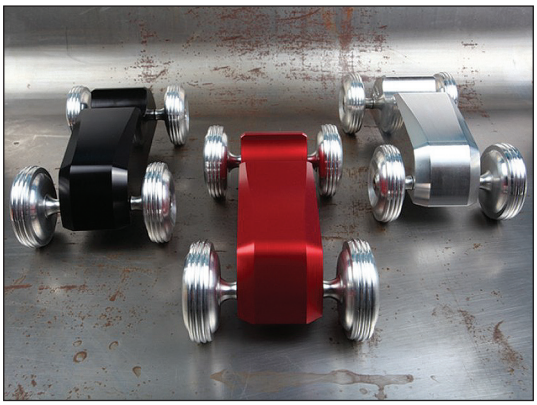
Examiner only

6. Ferrous and non-ferrous metals

(a) The pictures below are of a child's toy made from machined aluminium.



(i) State the name of the component used to attach the wheels of the child's toy. [1]

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(ii) State the name of the machine used to create the axle holes in the wheels of the child's toy. [1]

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(iii) The child's toys have different finishes applied. Explain why a finish is used. [2]

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Examiner only

(iv) The image below shows a piece of equipment used to finish some parts of the child's toy.

State the name of this piece of equipment. [1]

.....

(v) The child's toy car wheels have been machined from an aluminium round bar. Describe how to manufacture the wheels of the toy. [4]

	Description of manufacturing the wheels
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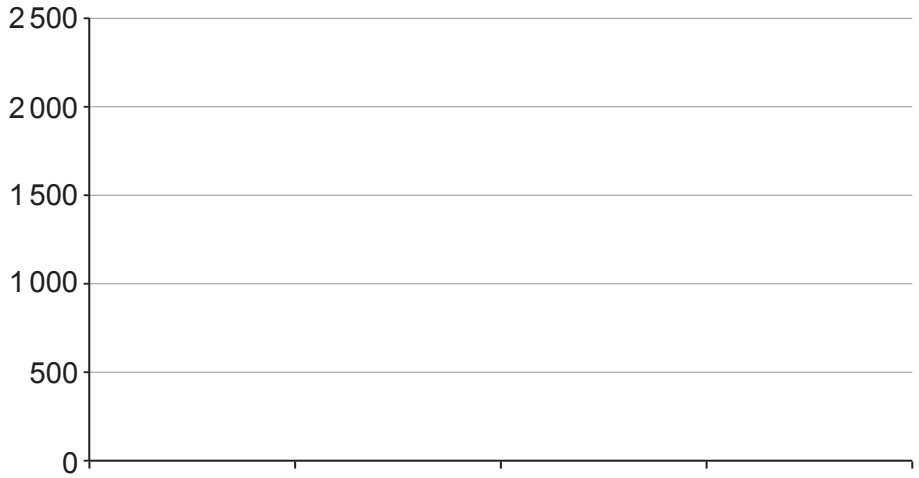
Examiner only

(b) A retailer tracked the sales of the child's toy over a 4-month period. The table below displays the data collected.

Sales (£)	**Month**
1 500	December
2 500	January
750	February
500	March

(i) In the space below draw and label a bar chart showing the sales data found in the table above. [3]

Bar chart of sales



Examiner only

(ii) The retailer pays 20% Value Added Tax (VAT) on all sales. Calculate how much VAT will need to be paid for the child's toy sales over the 4-month period. Show all workings. [2]

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(c) Raw aluminium comes from mining an ore which is then processed into the material used to manufacture the child's toy.

Analyse the impact mining aluminium has on our ecological footprint. [5]

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(d) Evaluate why prototyping and modelling design ideas benefits both the designer and the manufacturer when designing the child's toy. [6]

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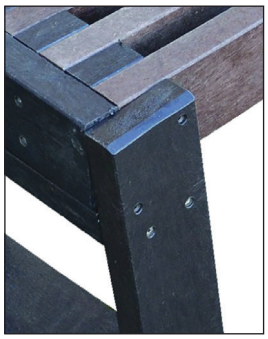
Examiner only

6. Thermosetting and thermoforming plastics

(a) The pictures below show a public bench manufactured from recycled plastic products.



(i) State the name of a fixture used to assemble the public bench. [1]

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(ii) The public bench has been manufactured from recycled HDPE (High-density polyethylene) plastic.

State the name of a product that could have been recycled to make the public bench. [1]

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(iii) Explain why HDPE is an appropriate plastic to use in the manufacture of the public bench. [2]

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Examiner only

(iv) The image below shows a machine used to create holes in the public bench.

State the name of the machine. [1]

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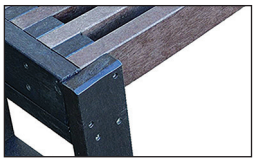
(v) The picture below shows the leg of the public bench assembled. Describe the joining process. [4]

	Description of joining process
	.....
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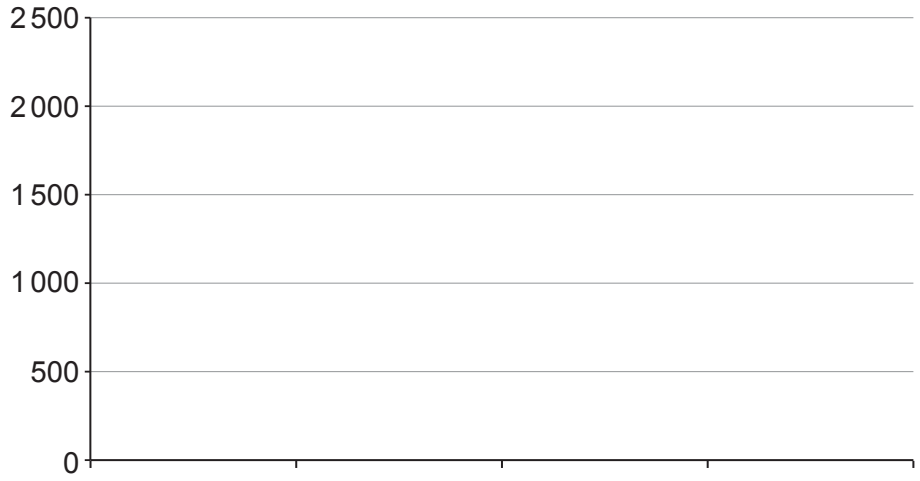
Examiner only

(b) A retailer tracked the sales of the public bench over a 4-month period. The table below displays the data collected.

Sales (£)	**Month**
1 500	December
2 500	January
750	February
500	March

(i) In the space below draw and label a bar chart showing the sales data found in the table above. [3]

Bar chart of sales



Examiner only

(ii) The retailer pays 20% Value Added Tax (VAT) on all sales. Calculate how much VAT will need to be paid for the public bench sales over the 4-month period. [2]
Show all workings.

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(c) The plastic used to make the public bench comes from recycled plastics. This has an impact on our environment.

Analyse the impact recycled plastics have on our ecological footprint. [5]

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(d) Evaluate why prototyping and modelling design ideas benefit both the designer and the manufacturer when designing a public bench. [6]

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Examiner only

6. Fibres and textiles

(a) The picture below is of a skirt made from a blend of wool and silk.

(i) State the name of the component used to fasten the skirt. [1]

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(ii) The skirt is constructed using darts. State the function of a dart. [1]

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(iii) The skirt's waistband is interfaced. Explain why interfacing is used in clothing construction. [2]

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Examiner only

(iv) The image below shows a piece of equipment used to edge finish the skirt's seams.

State the name of the piece of equipment. [1]

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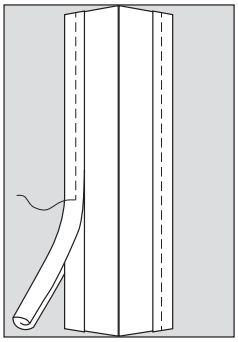
(v) The picture below shows how the skirt's plain seams could be edge finished with bias binding. Describe how to manufacture the seam. [4]



Description of seam manufacture

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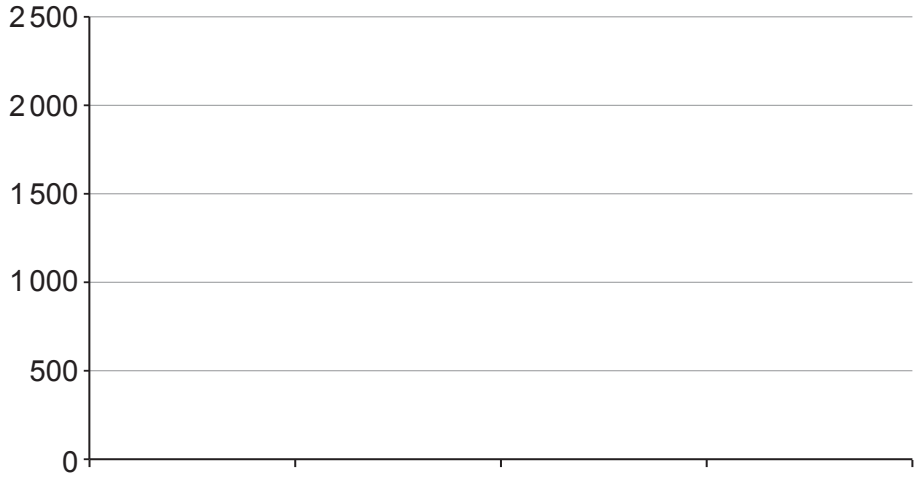
Examiner only

(b) A retailer tracked the sales of the skirt over a 4-month period. The table below displays the data collected.

Sales (£)	**Month**
1 500	December
2 500	January
750	February
500	March

(i) In the space below draw and label a bar chart showing the sales data found in the table above. [3]

Bar chart of sales



Examiner only

(ii) The retailer pays 20% Value Added Tax (VAT) on all sales. Calculate how much VAT will need to be paid for the skirt sales over the 4-month period. Show all workings. [2]

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(c) Wool and silk are natural protein fibres and were used for the fabric of the skirt.

Analyse the impact farming these fibres has on our ecological footprint. [5]

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(d) Evaluate why prototyping and modelling design ideas benefit both the designer and the manufacturer when designing a skirt. [6]

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END OF PAPER

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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