

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

C600U10-1



THURSDAY, 18 NOVEMBER 2021 – AFTERNOON

DESIGN AND TECHNOLOGY

Component 1

DESIGN AND TECHNOLOGY IN THE 21st CENTURY

2 hours

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

C600U101
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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.

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 continuation page 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.

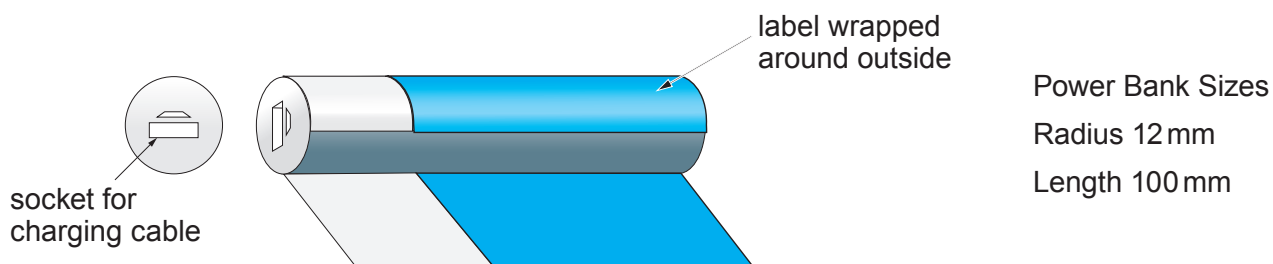
SECTION A

Answer **all** questions.

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This question is about Design and Technology and our world.

1. The image below is of a Power Bank which is used to recharge electrical products such as mobile phones, computer tablets and most electronic handheld devices.



- (a) (i) Give **one** reason why the size of the product is designed to be compact. [1]

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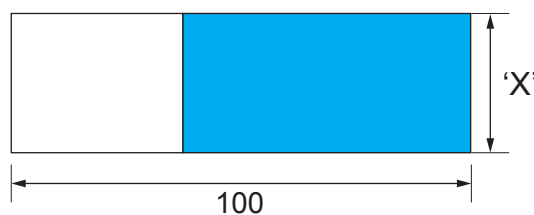
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- (ii) Using the sizes provided calculate the diameter of the Power Bank. [1]

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- (iii) The Power Bank has a label wrapped around the outside. Calculate the missing size 'X' of the **label**. *Show all workings.* [2]



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- (iv) Explain **one** disadvantage to the consumer of using a Power Bank. [2]

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- (b) (i) Explain the meaning of the term 'technology push'. [2]

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- (ii) Mobile phone screens have been influenced by technology push.

Discuss how technology push has influenced the design of a mobile phone screen. [2]

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This question is about materials technology.

2. (a) The image shown below is a protective glove which is made from a technical material.



- (i) State the name of the technical material used. [1]

- (ii) Describe why this technical material is used to make protective clothing. [2]

- (b) The image below shows sportswear manufactured from an interactive fabric.



- Explain the term 'interactive fabric'. [2]

(c) Describe **one** benefit to the user when wearing interactive sportswear.

[2]

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(d) Analyse the disadvantages of using interactive fabrics in sportswear.

[3]

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This question is about electronic systems, programmable components and mechanical devices.

3. (a) The picture below shows an image of a drone made by a student. In the initial prototyping stage a pulley system was considered.

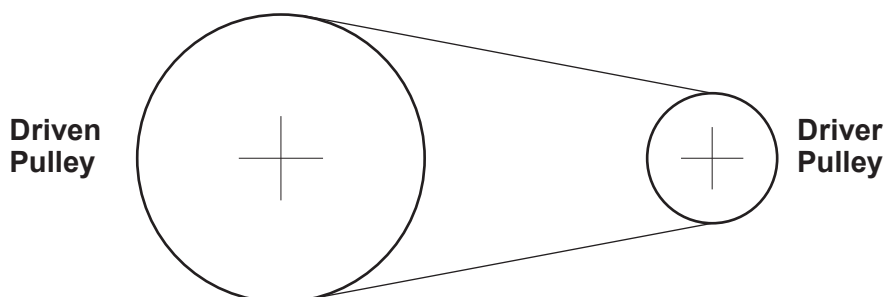


- (i) Read the following two statements and circle if they are True or False.

A pulley is a wheel with a groove running around the outside. True or False [1]

The drone does not need an energy source to fly. True or False [1]

- (ii) The diagram below shows the pulley system used in the drone.



Explain why the driven pulley rotates slower than the driver pulley. [2]

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- (iii) The pulley system has a velocity ratio of 1:2. The speed of the driver pulley is 20 revolutions per minute. Calculate the speed of the driven pulley. *Show all workings.* [2]

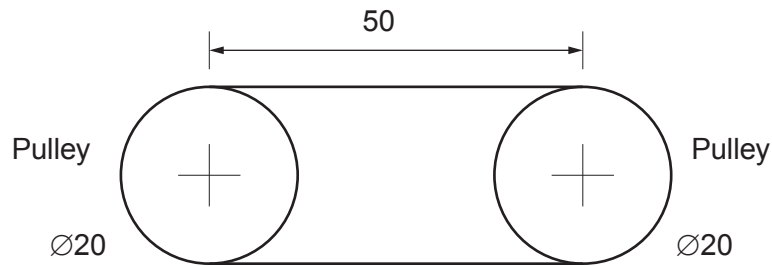
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- (iv) The pulley system shown below uses two pulleys both of equal size.

NOTE: sizes in millimetres.



Calculate the length of the pulley belt required for the system.
Show all workings.

[3]

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- (v) Explain **one** advantage of using a pulley system when developing the design of the drone. [2]

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- (b) Discuss in detail the social and moral issues of flying drones in public spaces. [4]

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This question is about materials.

4. (a) The image below shows an outdoor storage bag.



- (i) Complete the table shown below, by correctly placing a **tick** (✓) in the box. [1]

Description	True	False
Natural polymers come from plants or animals.		

- (ii) Name a suitable synthetic textile material for the body of the storage bag. [1]

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- (iii) Describe **one** property of the synthetic textile material that makes it suitable for outdoor use. [2]

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- (b) The image below shows a pair of safety glasses made from a thermoforming plastic.



- (i) Explain the term thermoforming. [2]

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- (ii) Name a thermoforming plastic that could be used to make the safety glasses and explain a characteristic or property that makes it suitable. [3]

Name:

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- (c) The image below shows an outdoor Teak bench.



- (i) Explain **one** property that makes Teak a suitable material for the outdoor bench.

[2]

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- (ii) State **two** suitable finishes that could be used to protect the outdoor Teak bench.

[2]

Finish 1:

Finish 2:

(d) Below are pictures of deciduous and coniferous trees.



(i) Complete the table shown below, by correctly placing **one tick (✓)** in either box. [2]

Description	True	False
A hardwood comes from a coniferous tree.		
A hardwood tree loses its leaves during autumn and winter.		

(ii) Describe the difference between deciduous and coniferous trees.

[2]

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- (e) Shown below is a traditional set of weighing scales used in the home. The scales are made from ferrous and non-ferrous metals.



- (i) State the difference between ferrous and non-ferrous metals.

[1]

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- (ii) Name **one** ferrous and **one** non-ferrous metal suitable for the manufacture of the weighing scales.

[2]

Ferrous metal:

Non-ferrous metal:

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5. Carefully study the images below and select **one** product to refer to when answering the questions (a) to (c) if appropriate. Place a **tick** (✓) in the box of your selected product.

		
☐	☐	☐
		
☐	☐	☐

- (a) The products shown above could be categorised into the following material groups:

WOOD METAL PLASTIC TEXTILE ELECTRONIC CARD

- (i) Circle the most appropriate category above for the product you have chosen. [1]
- (ii) Explain and discuss **one** essential anthropometric requirement of **your chosen** product. [2]

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- (b) (i) Discuss the importance of prototyping **your chosen** product prior to its manufacture. [2]

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only

- (ii) Evaluate your chosen product against **each** specification point in the table below. $4 \times [1]$

Specification point	Evaluation
Function	
Quality	
Target market	
Material	

- (c) Discuss how any **two** of the 6Rs could have been used to influence the design of **your chosen** product. [4]

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- (d) Analyse why it is essential for designers to consider the ecological footprint of a product. [2]

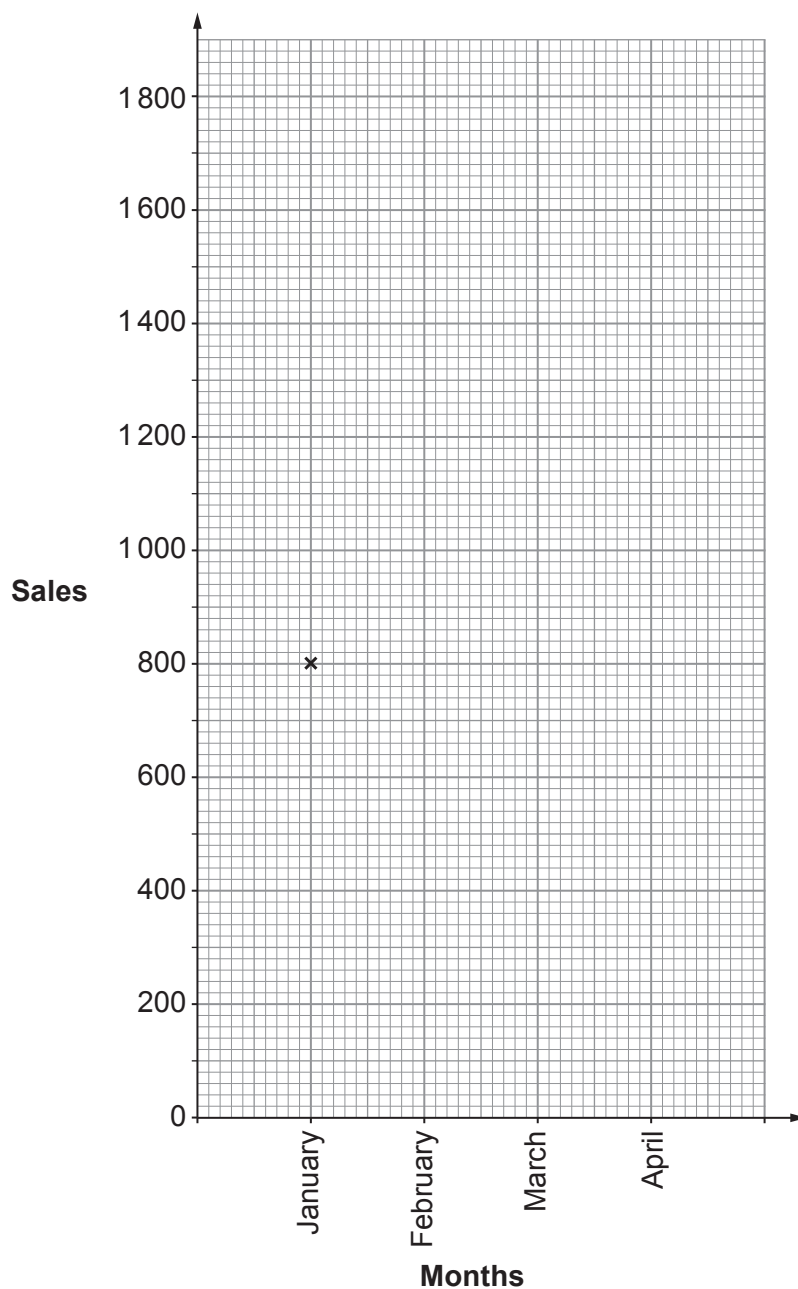
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- (e) Shown below is a partially completed graph for the sale of goods during the first quarter of the year 2019.

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- (i) Using the information in the table below complete the graph shown above.

[4]

First quarter of the year 2019	Sales
January	800
February	1 200
March	1 500
April	1 900

- (ii) State the name of the type of graph you have drawn.

[1]

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	☐	19–23
Papers and boards	☐	24–27
Natural and manufactured timber	☐	28–31
Ferrous and non-ferrous metals	☐	32–35
Thermoforming and thermosetting polymers	☐	36–39
Fibres and textiles	☐	40–43

Now answer all parts of your chosen topic.

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SECTION B**6. Electronic systems, programmable components and mechanical devices**

- (a) The picture below is of a pedestrian crossing unit.



- (i) State the type of lights used in the pedestrian crossing unit.

[1]

- (ii) Using the image below describe the part of the control system which is the input and the output.

[2]



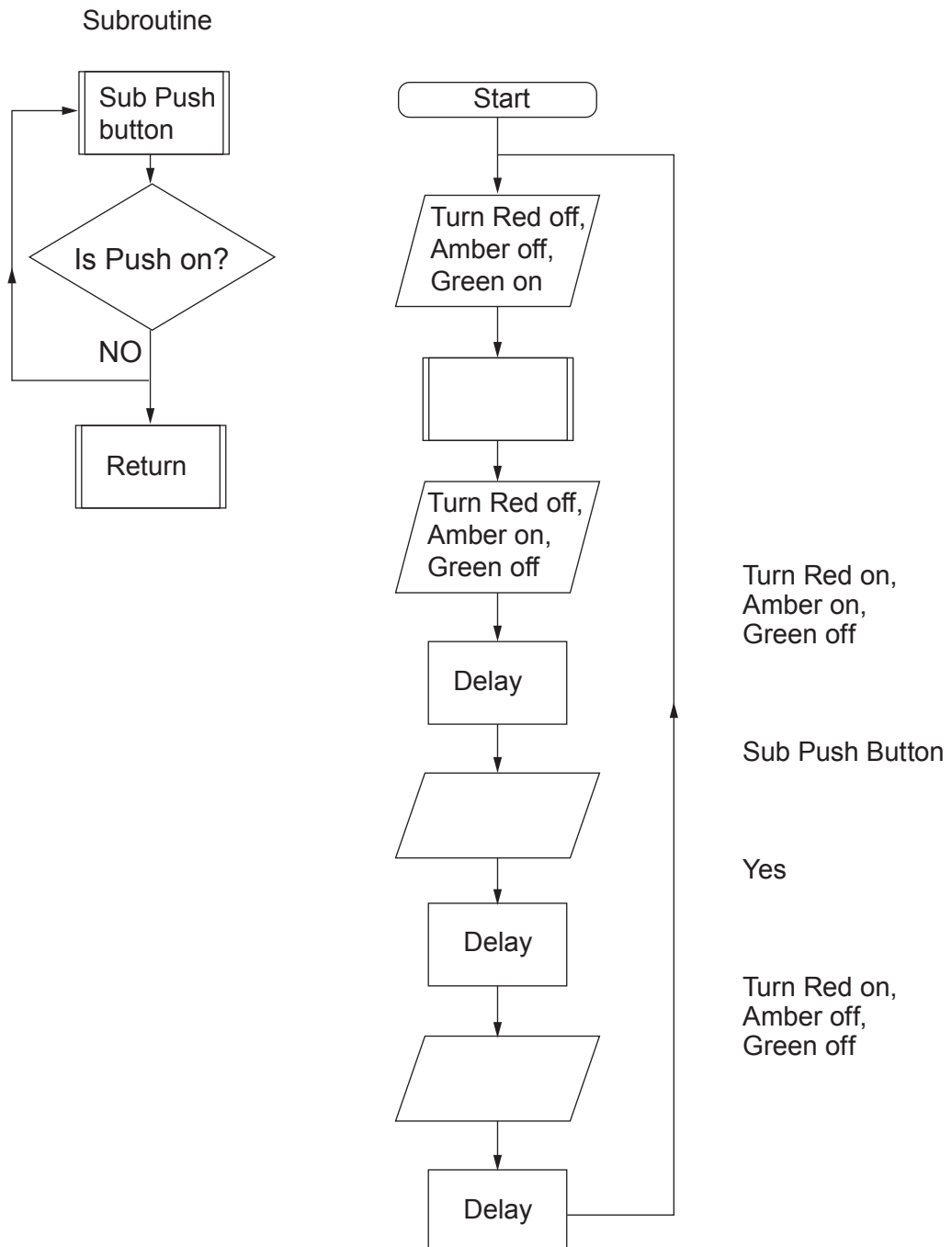
- (iii) The image below shows another active pedestrian crossing unit. Using the space provided, draw a simple flow chart below to continuously keep the green light on.

[2]

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only

- (iv) The pedestrian crossing unit is designed to include a subroutine that waits for the input sensor to be activated.

Complete the flow chart below to show the sequence of the pedestrian crossing unit. [4]



- (b) A PCB (Printed Circuit Boards) manufacturer owns 25 CNC (Computer Numeric Control) machines. Each machine takes 5 minutes to manufacture a PCB.

Calculate how many PCBs would be cut in an 8-hour shift using 25 CNC machines. [5]

Show all workings.

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- (c) Analyse the quality control checks that need to be performed when using a CNC machine to engrave a circuit board. [5]

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- (d) Evaluate the benefits of using a CNC machine to make the circuit boards instead of constructing them by hand. [6]

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6. Papers and boards

- (a) The picture below shows a set of child's self-assembly 3D beetles, made from printed laminated cardboard.



- (i) State the name of a suitable CAD (Computer Aided Design) software package used to create the 3D beetles. [1]

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- (ii) The 3D beetles have been designed on a CAD system.
Describe **one** reason why a CAD system has been used to design the 3D beetles. [2]

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- (iii) The 3D beetles have been manufactured on a CAM (Computer Aided Manufacture) system.
Describe **one** advantage of using CAM. [2]

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- (iv) In the space below, draw a simple flow diagram describing the main stages of producing a CAD drawing suitable for laser cutting. [4]

Examiner
only

- (b) A manufacturer who laser cuts the 3D card beetle sets owns 25 laser cutting machines. Each set of 3D card beetles takes 5 minutes to laser cut.

Calculate how many 3D card beetle sets would be cut in an 8-hour shift using 25 laser cutting machines. [5]

Show all workings.

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- (c) Analyse the quality control checks that need to be performed when using a laser to cut the 3D card beetles. [5]

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- (d) Evaluate the benefits of using a laser cutter to make the 3D card beetle sets instead of cutting out by hand. [6]

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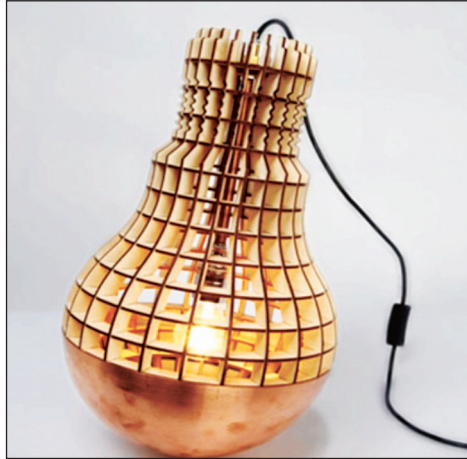
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6. Natural and manufactured timber

- (a) The picture below is of a laser cut plywood light.



- (i) State the name of a suitable CAD (Computer Aided Design) software package used to create the structure of the light. [1]

- (ii) The light has been designed on a CAD system. Describe **one** reason why a CAD system has been used to design the plywood light. [2]

- (iii) The plywood light has been manufactured on a CAM (Computer Aided Manufacture) system. Describe **one** advantage of using CAM. [2]

- (iv) In the space below, draw a simple flow diagram describing the main stages of producing a CAD drawing suitable for laser cutting. [4]

Examiner
only

- (b) A manufacturer who laser cuts the plywood for the light owns 25 laser cutting machines. Each plywood light takes 5 minutes to laser cut the shapes.

Calculate how many plywood lights the manufacturer makes in an 8-hour shift using 25 laser cutting machines.

Show all workings.

[5]

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- (c) Analyse the quality control checks that need to be performed when using a laser to cut the plywood shapes. [5]

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- (d) Evaluate the benefits of using a laser cutter to make the parts of the plywood light instead of cutting out each part by hand. [6]

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6. Ferrous and non-ferrous metals

- (a) The picture below is of a laser cut metal light shade.



- (i) State the name of a suitable CAD (Computer Aided Design) software package used to create the light shade. [1]

- (ii) The light shade has been designed on a CAD system. Describe **one** reason why a CAD system has been used to design the light shade. [2]

- (iii) The light shade has been manufactured on a CAM (Computer Aided Manufacture) system. Describe **one** advantage of using CAM. [2]

- (iv) In the space below, draw a simple flow diagram describing the main stages of producing a CAD drawing suitable for laser cutting. [4]

Examiner
only

- (b) A manufacturer who laser cuts the light shade owns 25 laser cutting machines. Each light shade takes 5 minutes to laser cut.

Calculate how many light shades the manufacturer makes in an 8-hour shift using 25 laser cutters. [5]

Show all workings.

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- (c) Analyse the quality control checks that need to be performed when using a laser to cut out the parts of the metal light shade. [5]

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- (d) Evaluate the benefits of using a laser cutter to make the light shade instead of cutting it out by hand. [6]

Examiner
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6. Thermoforming and thermosetting polymers

- (a) The picture below is of a laser cut key ring.



- (i) State the name of a suitable CAD (Computer Aided Design) software package used to create the key ring. [1]

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- (ii) The key ring has been designed on a CAD system.
Describe **one** reason why a CAD system has been used to design the key ring. [2]

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- (iii) The key ring has been manufactured on a CAM (Computer Aided Manufacture) system.
Describe **one** advantage of using CAM. [2]

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- (iv) In the space below, draw a simple flow diagram describing the main stages of producing a CAD drawing suitable for laser cutting. [4]

Examiner
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- (b) A manufacturer who laser cuts the key rings owns 25 laser cutting machines.
Each key ring takes 5 minutes to laser cut.

Calculate how many key rings the manufacturer makes in an 8-hour shift using 25 laser cutting machines. [5]

Show all workings.

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- (c) Analyse the quality control checks that need to be performed when using a laser to cut out the key rings. [5]

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- (d) Evaluate the benefits of using a laser cutter to make the key ring instead of cutting it out by hand. [6]

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6. Fibres and textiles

- (a) The picture below is of a decorative badge attached to a sports shirt.



- (i) State the name of the decorative process used to create the badge. [1]

- (ii) The badge has been designed on a CAD (Computer Aided Design) system. Describe **one** reason why a CAD system has been used to design the badge. [2]

- (iii) The badge has been manufactured on a CAM (Computer Aided Manufacture) system. Describe **one** advantage of using CAM. [2]

- (iv) In the space below, using notes and sketches, describe the decorative process of appliqué. [4]

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only

- (b) A manufacturer who forms the badges owns 25 specialist machines. Each badge takes 5 minutes to manufacture.

Calculate how many badges the manufacturer makes in an 8-hour shift using all 25 specialist machines.

Show all workings.

[5]

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- (c) Analyse the quality control checks that need to be performed during the decorative process of appliqué. [5]

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- (d) Evaluate the benefits of using a CAM embroidery machine instead of embroidering by hand. [6]

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END OF PAPER

