

Surname	Centre Number	Candidate Number
Other Names		0



GCSE – NEW

C600U10-1



FRIDAY, 24 MAY 2019 – 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
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.

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

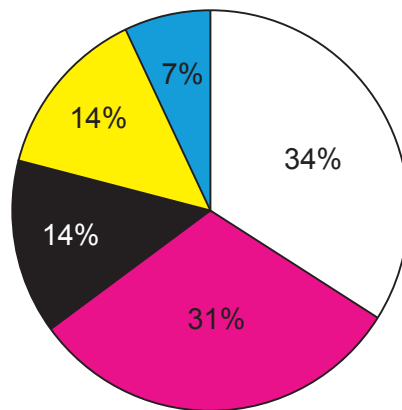
You are reminded of the necessity for good English and orderly presentation in your answers.

SECTION A*Answer all questions.*

This question is about the life cycle of products.

1. (a) The average UK household spends approximately £1800 per year on clothes.

The pie chart below shows the destination percentages of these clothes once they are no longer required by their original owner.

DESTINATION OF USED CLOTHING IN THE UK

☐ Overseas reuse
 ☐ Landfill
 ☐ UK Reuse
 ☐ Recycling
 ☐ Incineration

- (i) State the percentage of clothes that were sent to landfill. [1]

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- (ii) Calculate the percentage of clothes that were incinerated and sent to landfill. [1]

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- (iii) If all the clothes that were incinerated and sent to landfill were recycled, how much of the £1 800 would be spent on recycling? (Show all workings.) [2]

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- (iv) Explain the meaning of the term 'carbon footprint'.

[2]

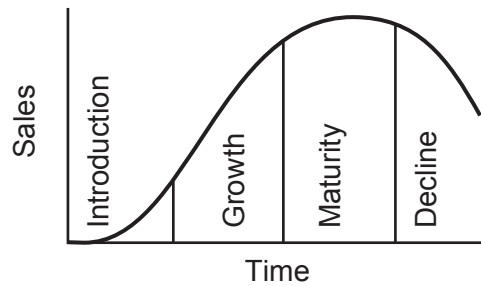
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- (b) (i) The diagram below shows a typical product life cycle. Explain what happens during the decline stage. [2]

The Product Life Cycle Stages



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- (ii) Many products end up in landfill sites. Explain the impact this has on the environment. [2]

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This question is about materials technology.

2. (a) The sportswear images below have been made from a material called Rhovyl.



Describe the properties of this material when used for sportswear.

[3]

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- (b) A blend of Nomex and Kevlar is used to manufacture the fabric of a fire-person's uniform, as seen in the picture below.



Explain the advantages of blending these fibres together.

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- (c) The cutlery handle below has been formed using Polymorph pellets.



Describe how the Polymorph pellets are used to make the cutlery handle.

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- (d) Polymorph is classed as a smart material. Analyse how the use of a different smart material in a product could be a safety or warning feature to the user.

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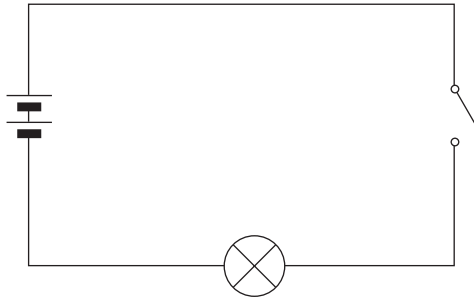
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This question is about electronic systems, programmable components and mechanical devices.

3. (a) The following is a diagram of a simple circuit.



- (i) On the circuit diagram above, label the power source and the switch. [2]
- (ii) The image below shows a modern street light. Explain how LDRs (Light Dependant Resistors) work in modern street lighting. [2]



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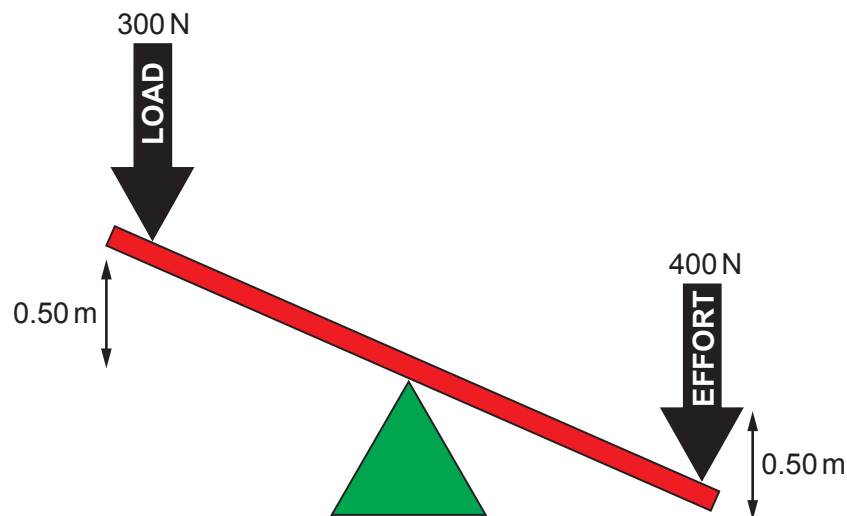
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- (b) This question is about mechanical advantage and velocity ratio calculations.

Study the picture below before answering the questions that follow.



- (i) Calculate both the mechanical advantage and velocity ratio of the see-saw.
(Show all workings.)

2 × [2]

Mechanical Advantage:

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Velocity Ratio:

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- (ii) Explain the role of the fulcrum in the see-saw.

[1]

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- (iii) State what would happen if you changed the position of the fulcrum.

[1]

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- (c) (i) Describe the difference between a microprocessor and a microcontroller.

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- (ii) Explain **one** disadvantage of using a programmable microcontroller.

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This question is about materials.

4. (a) The image below shows corrugated cardboard which is used for packaging.



- (i) The weight of paper and cardboard is measured in gsm. State the full meaning of gsm. [1]

G S M

- (ii) State how the structure of corrugated cardboard makes it suitable for packaging. [1]

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- (iii) Describe **one** disadvantage of corrugated cardboard when used to make models. [2]

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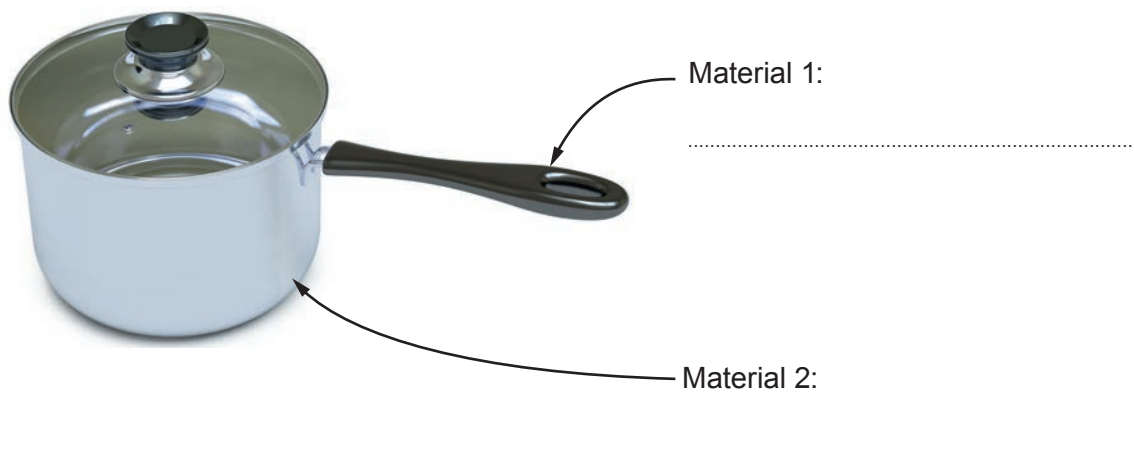
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(b) The image below is of a modern-day saucepan.

- (i) Label the **two** most suitable materials used to manufacture the saucepan pictured below. 2 × [1]



- (ii) Discuss the working properties of **one** of the materials identified in (i) above that make it suitable for the saucepan. [2]

Chosen material:

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- (c) The picture below is a radiator cover made from MDF.



- (i) State the full meaning of MDF. [1]

M D F

- (ii) Name a piece of CAM (Computer Aided Manufacture) equipment that could have been used to create the pattern on the radiator cover. [1]

- (iii) Discuss the reasons why MDF is such a versatile material in the construction of products such as the radiator cover. [4]

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- (iv) Explain using an example, how the aesthetic qualities of MDF can be improved. [2]

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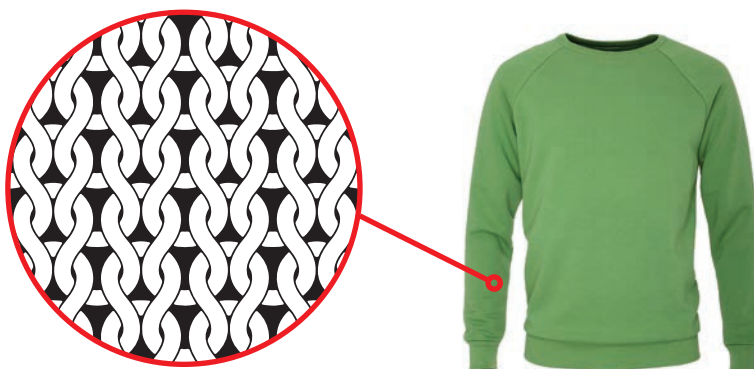
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- (d) Below is a picture of a jumper manufactured from a natural animal polymer.



- (i) Name the natural animal polymer used to manufacture this jumper. [1]

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- (ii) Describe why a natural animal polymer has been used for the knitted jumper. [3]

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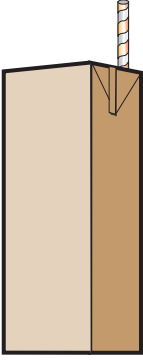
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5. Carefully study the images below and select **one** product to refer to when answering the questions (a) to (c). Place a **tick (✓)** in the box of your selected product.

		
<i>Drinks carton</i> <input data-bbox="491 869 566 952" type="checkbox"/>	<i>Fabric bag for life</i> <input data-bbox="922 869 997 952" type="checkbox"/>	<i>Watch with metal strap</i> <input data-bbox="1356 869 1431 952" type="checkbox"/>
		
<i>Under bed boxes</i> <input data-bbox="491 1433 566 1516" type="checkbox"/>	<i>LED head torch</i> <input data-bbox="922 1433 997 1516" type="checkbox"/>	<i>Veneer packaging/boxes</i> <input data-bbox="1356 1433 1431 1516" type="checkbox"/>

(a) Most products are designed with more than one function in mind.

(i) State the main function of your chosen product.

[1]

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- (ii) Analyse why your chosen product's material is sustainable. [2]

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- (b) Collecting primary and secondary source research is required to ensure client and user needs are identified and met when designing.

- (i) Describe using examples, the differences between primary and secondary source research. [3]

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- (ii) Evaluate how successful your chosen product is in terms of its ergonomic design. [4]

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- (c) (i) Explain why a user-centred design approach is so important for the successful design of your chosen product. [2]

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- (ii) All of these products have been manufactured commercially, but in various quantities. Identify which scale of production is being described below:

I. A continuous run of identical products. [1]

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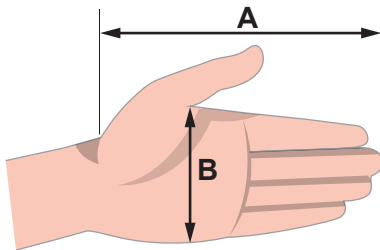
II. A small product run of identical products. [1]

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III. A unique product made for one person. [1]

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- (d) The picture and table below show collected anthropometric data from five students' hand measurements.



Student	Length (A)	Width (B)
1	100 mm	53 mm
2	103 mm	45 mm
3	90 mm	48 mm
4	95 mm	44 mm
5	102 mm	50 mm

- (i) State which student has the shortest hand length. [1]

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- (ii) Calculate the average hand width of all five students. (*Show all workings.*) [2]

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- (iii) The average diameter of the index finger of the five students was found to be 16 mm.

Calculate the circumference of the index finger so that a suitable length of silver wire can be used to make a circular ring.

(Show all workings.)

[2]

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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
Metals: Ferrous and non ferrous metals	☐	30-33
Thermoforming and thermosetting polymers	☐	34-37
Fibres and textiles	☐	38-41

Now answer all parts of your chosen topic.

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

(a) The picture below is of a Robotic Vacuum Cleaner.



- (i) The robotic vacuum cleaner is commercially manufactured in batches. Name a suitable method of construction used to make the main body casing. [1]

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- (ii) Outline **two** advantages of using the method of manufacture identified in (i) above. [2]

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- (iii) Name a suitable thermoplastic to make the main body casing and give **one** reason why it is suitable. [2]

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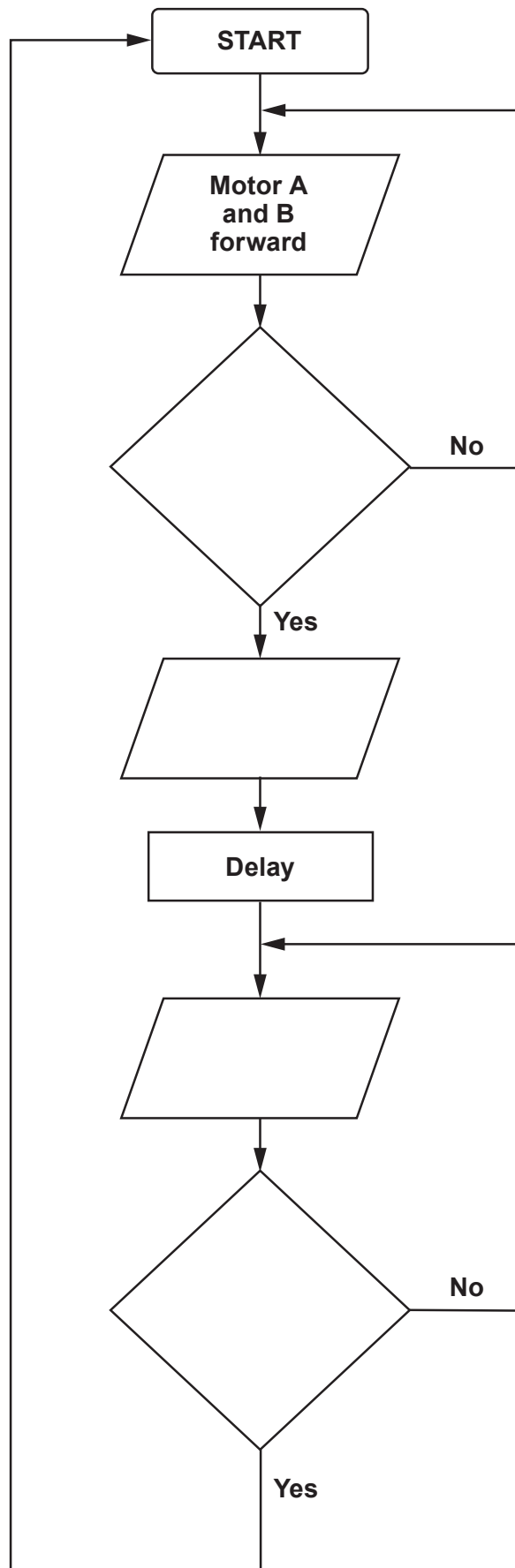
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- (iv) At the end of every use, the robotic vacuum cleaner parks itself in a charging dock. Complete the flow chart below using the stages listed to show control of the vacuum cleaners movements. [4]

Examiner
only



STAGES

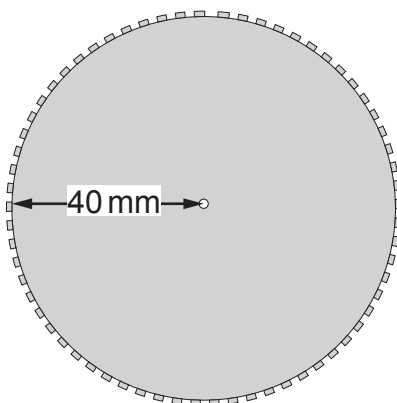
Motor A off
motor B
forward

Dust
container
sensor
activated

Proximity
sensor
activated

Motor A and
motor B
forward

- (b) The battery life of the robotic vacuum cleaner is equal to 175 revolutions of its wheel, shown below. After 150 revolutions, the robotic cleaner returns to the docking station for a recharge.
(Show all workings.)



- (i) Calculate the diameter of the wheel. [1]

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- (ii) Calculate the circumference of the wheel. [2]

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- (iii) Calculate how far the robotic cleaner will have travelled before it returns to the docking station. [1]

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- (iv) Round off your answer in (iii) above to the nearest metre. [1]

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- (c) A new robotic vacuum cleaner comes with main component parts, accessories and packaging.

Undertake a Life Cycle Analysis of this electronic product explaining the impact it has on the environment. [5]

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- (d) The robotic vacuum cleaner was manufactured in a factory that uses a batch production system.

Evaluate the benefits of this method of production. [6]

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6. Papers and boards

- (a) The image below shows a set of disposable snap-off memory sticks.



- (i) State the name of the process used to cut out the shape of the memory sticks. [1]

- (ii) The memory sticks are manufactured without the use of any glue.
Give **two** advantages of manufacturing the memory sticks in this way. [2]

- (iii) Explain the finishing process used to create the company logo on the front of the memory stick. [2]

- (iv) Using notes and sketches, describe how you would accurately manufacture multiple card prototypes of the memory stick in a school setting. [4]

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- (b) When manufacturing the memory sticks, the electronic components cost £0.35 and the card costs £0.15 per unit. The assembly and manufacture of the memory sticks costs a further £1.08 per unit.

- (i) Calculate how much it would cost the manufacturer to make 60,000 units of the memory stick.
(Show all workings.) [1]

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- (ii) The manufacturer sells the memory stick for £3.50. Calculate how much money the manufacturer would receive if they sold 80% of the 60,000 units.
(Show all workings.) [2]

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- (iii) Calculate the profit the manufacturer would make from the answer provided in (ii).
(Show all workings.) [2]

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- (c) Analyse why a growing number of products use recycled boards and papers as an
alternative to plastics and other materials. [5]

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- (d) Different parts of the memory sticks are manufactured in different parts of the world and shipped to a central location where they are assembled and packaged.

Evaluate the benefits of manufacturing in this way.

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6. Natural and manufactured timber

- (a) The picture below is of a birch plywood stool.



- (i) The stool is commercially produced in small batches of 50,000. What method of construction would be used to manufacture the legs of the stool? [1]

- (ii) Give **two** reasons why birch plywood is a suitable material for the manufacture of the stool. [2]

- (iii) The manufacture of the stool relies on CNC (Computer Numerical Control) machining. Outline **two** advantages of using CNC machinery to manufacture the stool. [2]

- (iv) The stool has a clear finish of polyurethane varnish added to it. Using notes and sketches describe the stages required to prepare the surfaces of the stool and apply the polyurethane varnish. [4]

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- (b) When manufacturing the stool, the plywood cost £1.10, the assembly of the stool costs £3.05 and the cost of fittings was £0.20.

- (i) Calculate how much a batch order of 50,000 stools would cost the manufacturer to make.
(Show all workings.) [1]

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- (ii) The manufacturer sells the stool for £9.00. Calculate how much money the manufacturer would receive if they sold 80% of the 50,000 stools.
(Show all workings.) [2]

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- (iii) Calculate the profit the manufacturer would make from the answer provided in (ii).
(Show all workings.) [2]

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- (c) Hundreds of thousands of these stools are sold annually.

Undertake a Life Cycle Analysis of the stool explaining the impact it has on the environment. [5]

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- (d) The stool was made in a factory that uses a batch production manufacturing system.

Evaluate the benefits of this method of production.

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6. Metals: Ferrous and non ferrous metals

(a) The picture below shows some fizzy drinks cans.



- (i) The drinks cans are commercially produced and over two billion cans are manufactured annually. **Underline** the correct method of manufacture. [1]

One-off production

Batch production

Mass production

- (ii) The cans are manufactured from aluminium. Give **two** advantages why this is a suitable material to use. [2]

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- (iii) The manufacture of the cans relies on automated production. Outline **two** advantages of using automated machinery to manufacture the drinks cans. [2]

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- (iv) The design of the fizzy drinks can is shaped differently at its top, compared to the concave bottom.

Describe using notes and sketches how this helps the users stack the cans. [4]

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- (b) The fizzy drinks cans are manufactured at various locations across the world.
The average cost of making one aluminium can is £0.02 each.

- (i) Calculate how much an order of 950,000 cans would cost the manufacturer to make.
(Show all workings.) [1]

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- (ii) The manufacturing company can save up to 25% of an order by using recycled cans.

Calculate how much they would save on a repeat order that used recycled cans.
(Show all workings.) [2]

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- (iii) The actual selling cost of the fizzy drinks can is 50p. Calculate the profit the manufacturer would make if they used recycled cans on the order of 950,000. *(Show all workings.)* [2]

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- (c) Undertake a Life Cycle Analysis of a fizzy drinks can explaining the impact it has on the environment. [5]

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- (d) The fizzy drinks cans are made in a factory that uses a continuous flow production system.

Evaluate the benefits of this method of production.

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6. Thermoforming and thermosetting polymers

- (a) The image below shows a commercially used GPS drone. The drone is manufactured from a mix of polypropylene, epoxy resin and plastic laminates.



- (i) State the name of the process used to construct the rotor blades of the drone. [1]

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- (ii) Give **two** disadvantages of using polypropylene for the main body of the drone. [2]

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- (iii) Explain why the chassis of the drone uses plastic laminates in its construction. [2]

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- (iv) Using notes and sketches, describe how you would accurately manufacture the domed main body of the drone in a school setting. [4]

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- (b) A small lightweight drone is to be developed and manufactured for recreational use. The electronic components for the drone cost £2.35 and the plastics cost £3.15 per unit. The assembly and manufacture of the drone costs a further £4.08 per unit.

- (i) Calculate how much it would cost the manufacturer to make 12,000 drones. (Show all workings.) [1]

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- (ii) The manufacturer sells a drone to a retailer for £58.00.

Calculate how much money the manufacturer would receive if they sold 80% of the 12,000 units. (Show all workings.) [2]

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- (iii) Calculate how much profit the manufacturer would make from the answer provided in (ii).
(Show all workings.) [2]

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- (c) Analyse how consumers growing awareness of the impact of plastic waste is influencing manufacturers use of the material. [5]

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- (d) Different parts of a product are now being manufactured in different parts of the world. The parts are shipped to a central location where they are assembled and packaged.

Evaluate the benefits of manufacturing in this way.

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6. Fibres and textiles

- (a) The picture below is of a child's printed t-shirt.



- (i) The t-shirt is commercially manufactured in batches of 60,000. State what method of construction would be used to neaten the seams of the t-shirt. [1]

- (ii) T-shirts are made from knitted fabric. Give **two** reasons why a knitted construction is chosen for this type of child's clothing. [2]

- (iii) Transfer printing relies on CAM (Computer Aided Manufacture), outline **two** advantages of using CAM when printing on clothing. [2]

- (iv) The dinosaur design has been inkjet transfer printed. Using notes and sketches describe the stages you would take to inkjet transfer print the decoration onto a t-shirt within a school setting. [4]

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- (b) The t-shirt was manufactured in China and sold to a clothing company in the UK. The cotton yarn to make the fabric cost £0.25, the manufacture of the t-shirt cost £1.08 and the cost of the transfer printing was £0.35.

- (i) Calculate how much a batch order of 60,000 t-shirts would cost the manufacturer to make.
(Show all workings.) [1]

- (ii) The manufacturer sells the t-shirt for £2.50. Calculate how much money the manufacturer receives if they sold 80% of the 60,000 t-shirts.
(Show all workings.) [2]

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- (iii) Calculate how much profit the manufacturer would make from the answer provided in (ii).
(Show all workings.) [2]

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- (c) Billions of t-shirts are manufactured annually. Undertake a Life Cycle Analysis of a t-shirt explaining the impact it has on the environment. [5]

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- (d) The t-shirt was made in a factory that uses the manufacturing system of cell production.

Evaluate how cell production benefits the workforce.

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