



GCSE MARKING SCHEME

SUMMER 2023

**DESIGN AND TECHNOLOGY – COMPONENT 1
C600U10-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2023 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCSE DESIGN & TECHNOLOGY – COMPONENT 1

SUMMER 2023 MARK SCHEME

Guidance for examiners

Positive marking

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

Banded mark schemes

For band marked questions mark schemes are in two parts, the indicative content and the assessment grid.

The indicative content suggests the range of and issues which may be included in the learner's answers. It can be used to assess the quality of the learner's response. Indicative content is **not** intended to be exhaustive and learners **do not** have to include all the indicative content to reach the highest level of the mark scheme.

In order to reach the highest levels of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that it contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded. For each question, descriptors will indicate the different skills and qualities at the appropriate level.

Examiners should first read and place a tick in the learner's answer/s to indicate the evidence that is being assessed in that question; the mark scheme can then be applied. This is done as a two-stage process.

Stage 1 – Deciding on the band

Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptors for that band. If the descriptors at the lowest band are satisfied, examiners should move up to the next band and repeat this process for each band until the descriptors match the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance, if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark learners down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provide.

Section A

Answer **all** questions

This question is about Design and Technology and our world.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total																									
1. (a) (i)	✓	4	<p>The table below compares the annual costs of an electric car with a petrol car. Complete the table above by calculating the missing figures. Show your workings. [4]</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th></th> <th style="text-align: center;">Electric Car</th> <th style="text-align: center;">Petrol Car</th> <th style="text-align: center;">Difference</th> <th style="text-align: center;">Comparison</th> </tr> </thead> <tbody> <tr> <td>Purchase Cost</td> <td style="text-align: center;">£28,500</td> <td style="text-align: center;">£22,800</td> <td style="text-align: center;">£5,700</td> <td style="text-align: center;">25% more expensive</td> </tr> <tr> <td>Fuel/Energy Cost</td> <td style="text-align: center;">£342</td> <td style="text-align: center;">£876</td> <td style="text-align: center;"><u>£534</u></td> <td style="text-align: center;">61% cheaper</td> </tr> <tr> <td>Tax and Maintenance Cost</td> <td style="text-align: center;">£225</td> <td style="text-align: center;"><u>£443</u></td> <td style="text-align: center;">£218</td> <td style="text-align: center;">49% cheaper</td> </tr> <tr> <td>Total Annual Running Cost</td> <td style="text-align: center;">£1,650</td> <td style="text-align: center;">£2,370</td> <td style="text-align: center;">£720</td> <td style="text-align: center;"><u>30% cheaper</u></td> </tr> </tbody> </table> <p>Calculations: $£876 - £342 = £534$ (1) $£225 + £218 = £443$ (1) $£720/£2370, 0.30 \times 100 = 30.4\%$ Accept 30% (1) Correct workings evident (1)</p> <p><i>Only acceptable responses. Credit any appropriate approach to calculating the missing figures.</i></p>		Electric Car	Petrol Car	Difference	Comparison	Purchase Cost	£28,500	£22,800	£5,700	25% more expensive	Fuel/Energy Cost	£342	£876	<u>£534</u>	61% cheaper	Tax and Maintenance Cost	£225	<u>£443</u>	£218	49% cheaper	Total Annual Running Cost	£1,650	£2,370	£720	<u>30% cheaper</u>	AO4 1b [2] AO4 1c [2]	4
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Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)	✓		<p>Crude oil is an example of a non-renewable energy source. Name another non-renewable energy source. [1]</p> <p>Award one mark for a correct answer:</p> <ul style="list-style-type: none"> • Coal • Gas • Nuclear • Petrol <p><i>Credit any other appropriate response</i></p>	AO4 1b [1]	1
(iii)			<p>A hybrid car combines a petrol or diesel engine with an electric motor. It is an example of market pull. Describe the term 'market pull'. [2]</p> <p>Answers must relate to 'market pull' only.</p> <p>For example: Market pull is when a new product (or incrementally developed product) (1) is produced in response to consumer needs/demand from the market place. (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [2]	2

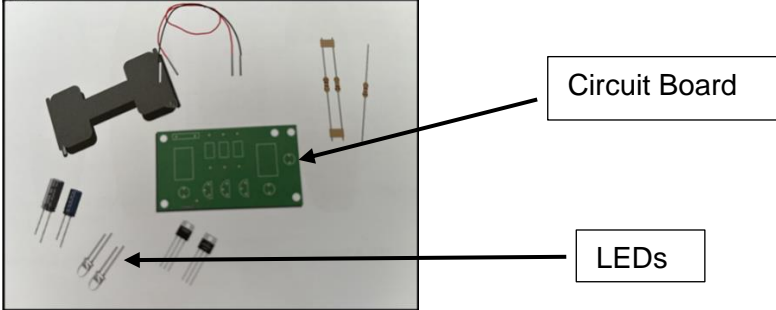
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b)			<p>Cars are manufactured globally. Explain how global manufacturing has a negative impact on our society. [3]</p> <p>1 mark for each negative impact and 1 mark for each explanation. A maximum of 2 marks for identifying negative benefits without any explanation. Full marks can be awarded if a negative impact highlighted has been fully explained and justified.</p> <p>For example: Negative impacts could include:</p> <ul style="list-style-type: none"> • Carbon footprint increased (1) due to transportation of products (1) • Fairtrade policies are not adhered to (1) as companies try to drive down selling price (1) • Use of automation and technology results in job losses (1) • Ethical and moral concerns (1) have been highlighted as the manufacturing markets become more competitive, for example, workers' wages are lowered (1), conditions they work in are poor (1) and this affects living standards (1) • Cultural beliefs and values (1) within the country manufactured can be ignored/not valued/taken account of (1) • Although technology and automation speeds up production, transportation can increase lead time (1) and shipping rates increase (based on demand) (1) which can be frustrating for customer (1) • Poor communication can lead to poor product quality (1) resulting in frustration for customer and return of product, (1) this affects company success and possible job losses (1) • Reduced local/national manufacturing output (1), reducing local jobs (and national income). <p><i>Credit any other appropriate response.</i></p>	AO4 1c [3]	3
				Total	10

This question is about materials technology.

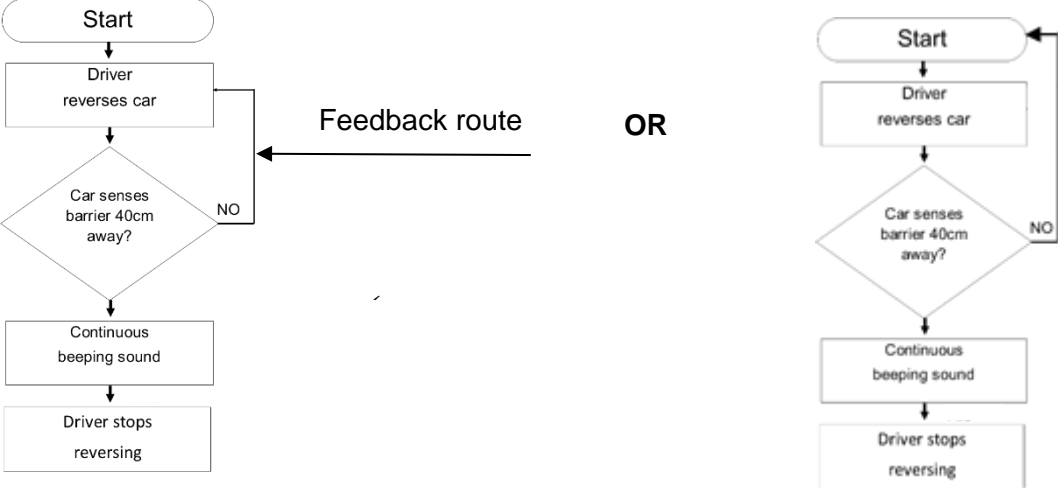
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total																
2. (a)	✓		<p>Select the correct description for each smart material listed by placing a tick (✓) in the table below. [3]</p> <table border="1" data-bbox="387 427 1758 719"> <thead> <tr> <th data-bbox="387 427 705 539">Description</th> <th data-bbox="705 427 1064 539">A material that changes colour when exposed to UV light.</th> <th data-bbox="1064 427 1422 539">A material that changes from an insulator to a conductor.</th> <th data-bbox="1422 427 1758 539">A material that changes colour when exposed to heat.</th> </tr> </thead> <tbody> <tr> <td data-bbox="387 539 705 592">Photochromic</td> <td data-bbox="705 539 1064 592" style="text-align: center;">✓</td> <td data-bbox="1064 539 1422 592"></td> <td data-bbox="1422 539 1758 592"></td> </tr> <tr> <td data-bbox="387 592 705 644">Thermochromic</td> <td data-bbox="705 592 1064 644"></td> <td data-bbox="1064 592 1422 644"></td> <td data-bbox="1422 592 1758 644" style="text-align: center;">✓</td> </tr> <tr> <td data-bbox="387 644 705 719">Quantum Tunnelling Composite</td> <td data-bbox="705 644 1064 719"></td> <td data-bbox="1064 644 1422 719" style="text-align: center;">✓</td> <td data-bbox="1422 644 1758 719"></td> </tr> </tbody> </table> <p>Award one mark for each correct response.</p> <p><i>Only acceptable responses.</i></p>	Description	A material that changes colour when exposed to UV light.	A material that changes from an insulator to a conductor.	A material that changes colour when exposed to heat.	Photochromic	✓			Thermochromic			✓	Quantum Tunnelling Composite		✓		AO4 1a [1] AO4 1b [2]	3
Description	A material that changes colour when exposed to UV light.	A material that changes from an insulator to a conductor.	A material that changes colour when exposed to heat.																		
Photochromic	✓																				
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(b)	✓		<p>Shape Memory Alloy (SMA) has been used for the manufacture of the eyeglass frame seen in the picture below.</p> <p>Explain why a Shape Memory Alloy has been used for the eyeglass frame. [2]</p> <p>Answer must relate to shape memory alloys only and be relevant to the eyeglass frame. 1 mark for a reason and an additional mark for an appropriate explanation.</p> <p>For example: Shape Memory Alloys have elastic properties (1) which allow the eyeglass frame to be bent without breakage or damage (1). Buckled frames can be returned to programmed shape (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1c [2]	2																

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(c)	✓		<p>The surfboards pictured below, are coated in a Glass Reinforced Plastic (GRP). Glass Reinforced Plastic is a composite material. Explain why a composite material is suitable for the coating of the surfboards. [2]</p> <p>Answer must relate to Glass Reinforced Plastic. 1 mark for a definition of a composite material or a definition of GRP. 1 mark for referencing properties of GRP to the surf board.</p> <p>For example: A composite material combines two or more materials to make use of their individual properties (1) A composite material combines materials to produce a more desirable set of properties (1) Glass Reinforced Plastic is a composite of glass fibres and polyester resin (1) The combination of glass fibres and polyester resin (1) ensures the coating of the surf board is tough and lightweight while still being rigid (1) Colour or surface pattern can still be seen (1) Hardy material that can withstand conditions outside with very little wear and tear (1).</p> <p><i>Credit any other appropriate response.</i></p>	AO4 2c [2]	2
(d)	✓		<p>Analyse the suitability of Glass Reinforced Plastic (GRP) as a sustainable material for the surf board. [3]</p> <p>Answers must relate to Glass Reinforced Plastic. 1 mark for one clear sustainable effect/impact, 1 mark for analysing the impact suggested and 1 mark for justifying answer given. Two effects with one clear explanation can be awarded 3 marks. Note: this is an analytical question on sustainability. Candidates may present both sides of an argument and should be awarded marks if accurately explained.</p> <p>For example:</p> <ul style="list-style-type: none"> • GRP is less energy intensive in its manufacture. • GRP doesn't produce toxic air pollutants in manufacture (like other materials). • A greater strength to weight ratio extends the life of the product. • GRP although petroleum based is a by-product. • GRP is difficult to recycle (1) as separating composites is extremely difficult. • GRP can be repaired (1) extending the life of the surfboard (1) <p><i>Credit any other appropriate response.</i></p>	AO3 2a [3]	3
				Total	10

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

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
3. (a) (i)	✓		<p>The image below shows the electronic component parts of a flashing bike light On the image above, label the:</p> <ul style="list-style-type: none"> • Circuit board • LEDs  <p>Award one mark for each correct response. <i>Only acceptable responses.</i></p>	AO4 1b [2] [2]	2
(ii)			<p>Identify another product, that could use the components of a flashing light.</p> <p>1 mark awarded for identifying an alternative appropriate product. For example: a warning beacon light, torch/flashlight, alarm system.</p> <p><i>Credit any appropriate response.</i></p>	[1] AO4 1b [1]	1

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b) (i)			<p>The image below is of a car fitted with ultrasonic reverse parking sensors. The sensors emit a constant beeping sound when the driver is within 40cm of an object.</p> <p>Use the statements provided in the table to complete the flow chart to show how the parking sensors operate.</p> <div style="display: flex; align-items: center;"> <div style="flex: 1;"> <pre> graph TD Start([Start]) --> Reverse[Driver reverses car] Reverse --> Decision{Car senses barrier 40cm away?} Decision -- NO --> Beeping[Continuous beeping sound] Beeping --> Stop[Driver stops reversing] </pre> </div> <div style="flex: 1; border: 1px solid black; padding: 5px; margin-left: 20px;"> <p>Parking sensor activities:</p> <ul style="list-style-type: none"> Car senses barrier 40cm away? No Continuous beeping sound Driver reverses car </div> </div> <p>1 mark for each correct placement of activity from those provided in the table.</p> <p><i>Only acceptable response.</i></p>	<p>AO4 1c [4]</p> <p>[4]</p>	<p>4</p>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>On the flow chat above, draw the feedback route for the parking sensors. [1]</p>  <p><i>Only accepted response.</i></p>	AO4 2b [1]	1
(c) (i)	✓	2	<p>The image below is of a LEGO merry-go-round product that uses a gear mechansim. The handle turns the drive gear which has 32 teeth and the driven gear which has 16 teeth. Calculate the gear ratio. Show all workings. [2]</p> <p><u>number of teeth in driven gear</u> number of teeth on drive gear</p> <p>The gear ratio is 1:2 (because $16/32 = 1/2$) 16/32 (1) 1:2 (1)</p> <p>OR</p>	AO4 1b [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
			<p><u>number of teeth in the drive gear</u> number of teeth in the driven gear</p> <p>The gear ratio is 2:1 (because $32/16 = 2:1$ 32/16 (1) 2:1 (1)</p> <p>Note: accept either ratio calculations as shown above.</p> <p><i>Credit any other appropriate calculation.</i></p>		
(ii)	✓	2	<p>If the handle rotates three times, calculate how many full rotations the merry-go-round will make. Show all workings. [2]</p> <p>Three turns of the 32 tooth gear produce six turns of the merry-go-round.</p> <p>$32 \times 3 = 96$, $96/16 = 6$ rotations</p> <p>Note: the drive gear, drives the rotation. The drive gear has 32 teeth.</p> <p><i>Credit any appropriate calculation.</i></p>	AO4 1b [2]	2
(iii)	✓		<p>Using an example of a named product explain the motion of a rack and pinion gear. [3]</p> <p>Up to 2 marks awarded showing understanding of a rack and pinion motion and 1 mark for stating an appropriate product that employs a rack and pinion gear mechanism.</p> <p>For example: A rack and pinion is a gear system employed to change between rotary and linear motion. (1) A stairlift is a product example. (1) The rack is stationary and attached to the stairs, the pinion (driven by a motor) climbs up the rack, moving the stairlift. (1) Other product examples: car jack, sliding gate, pillar drill, steering rack on car or go-cart.</p> <p><i>Credit any appropriate response.</i></p>	AO4 1b [1] AO4 2a [2]	3
				Total	15

This question is about materials.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total				
4. (a) (i)			<p>The images below show a packaging product made from recycled paper. Draw a circle around the correct words to complete the sentences that follow.</p> <table border="1" data-bbox="389 478 1496 782"> <tr> <td data-bbox="389 478 1068 622">The weight of paper is measured in</td> <td data-bbox="1068 478 1496 622"> grams per square inch grams per square metre </td> </tr> <tr> <td data-bbox="389 622 1068 782">Each time paper fibres get recycled they become</td> <td data-bbox="1068 622 1496 782"> weaker stronger </td> </tr> </table> <p><i>Only accepted responses.</i></p>	The weight of paper is measured in	grams per square inch grams per square metre	Each time paper fibres get recycled they become	weaker stronger	2 x [1] AO4 1a [2]	2
The weight of paper is measured in	grams per square inch grams per square metre								
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(ii)			<p>Describe how the designer has considered the safety of the product being packaged.</p> <p>One mark for a considered safety factor and 1 mark for description. Two marks can not be awarded for listing 2 different safety factors.</p> <p>For example: The concertina effect of the packaging (1) means it can be moulded to the shape of the product being packaged, protecting the whole of the product (1). The structure of the packaging (honeycomb or hexagonal cell structure) (1) is impact resistant (1).</p> <p><i>Credit any other appropriate response.</i></p>	[2] AO4 2b [2]	2				

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b) (i)			<p>The image below is of a toothbrush made from beech wood. Beech is a hardwood that comes from deciduous trees. Identify two characteristics of a deciduous tree. 2 x [1]</p> <p>One mark for each characteristic of a deciduous tree.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Deciduous trees have broad flat leaves • They drop their leaves during part of the year (usually autumn in the UK) • They need warm temperatures or tropical climates for successful growth • Most deciduous trees are slow growing <p><i>Credit any other appropriate response.</i></p>	AO4 1a [2]	2
(ii)	✓		<p>Describe why beech wood is a suitable material for the toothbrush. [2]</p> <p>Answer must relate to beech wood. 1 mark for an appropriate property, characteristic or finishing of beech wood and 1 mark for relating how the property, characteristic or finish, is appropriate for the toothbrush.</p> <p>Examples: Beech wood is an attractive wood (1) aiding the aesthetic of the product (1). Beech wood has high abrasion resistance (1) and is very hard and tough (1) ensuring the longevity of the toothbrush (1). Beech wood has good strength properties (1), has a close grain (1) and has a fine, even texture (1). Beech wood increases in durability when wet (1) and better water resistance can be achieved by applying a coating (2).</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1c [2]	2
(c) (i)	✓		<p>The picture below is of a bag made from a PVC coated nylon fabric. State the meaning of PVC. [1]</p> <p>PVC = Polyvinyl <u>Chloride</u></p> <p><i>Only appropriate response.</i></p>	AO4 1a [1]	1

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>Identify a suitable target market the bag would appeal to. [1]</p> <p>This bag would suit almost any target market. For example:</p> <ul style="list-style-type: none"> • Teenagers • Male/Female • LGBTQ+ • Adults • Fashion designers <p>Note: as the dimensions are not provided, accept the target market of children.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 2a [1]	1
(iii)	✓		<p>Discuss the reasons why PVC coated nylon is a suitable material for the bag. [4]</p> <p>Answers must be related to PVC and/or nylon. 1 mark for each benefit and up to 2 marks for justifications of the benefit. A maximum of 2 marks for identifying just properties without any justification.</p> <p>For example: PVC is a waterproof material (1) which helps to keep items in the bag dry when it rains (1) this also means the bag can be wiped with a damp cloth if it gets dirty (1). PVC is a durable coating (1) which helps to extend the life of the product (1).</p> <p>Other properties:</p> <ul style="list-style-type: none"> • light in weight • chemical resistant (resistant to UV, acids, alkalis and oils) • abrasion resistant • flexible • nylon is water resistant and PVC is waterproof <p><i>Credit any other appropriate response.</i></p>	AO4 1c [4]	4

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(iv)	✓		<p>Describe one reason why a knitted fabric would be an unsuitable choice for the bag. [2]</p> <p>Answer must relate to knitted fabric. 1 mark for providing a suitable reason why knitted fabric is an unsuitable material choice and 1 mark for describing/giving a reason why it is not suitable. A description is required for maximum marks.</p> <p>For example: Knitted fabric stretches (1) which would mean the shape of the bag would deform when storing items (1). Knitted fabrics are more difficult to laminate/coat (1) due to their open structure (1) giving an uneven finish that isn't as aesthetically pleasing (1).</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1c [2]	2
(d) (i)	✓		<p>The image below is a necklace made from copper and pewter. Copper and pewter are non-ferrous metals. Define the term non-ferrous. [1]</p> <p>For example: Non-ferrous metals do not contain iron (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1]	1
(ii)	✓		<p>Other than copper and pewter, give one example of a non-ferrous metal suitable for jewellery. [1]</p> <p>Examples of non-ferrous metals:</p> <ul style="list-style-type: none"> • Aluminium • Gold • Silver • Nickle • Brass <p><i>Credit any other appropriate response.</i></p>	AO4 1c [1]	1

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(iii)	✓		<p>Explain how the properties of non-ferrous metals make them suitable for jewellery. [2]</p> <p>Answer must relate to non-ferrous metals only. 1 mark for providing a suitable reason/property why non-ferrous metals are a suitable material choice for jewellery and 1 mark for giving an explanation why it is suitable. A short explanation is required for maximum marks.</p> <p>For example: Non-ferrous metals are suitable for jewellery products as they are very malleable (1) and can be shaped easily into a range of forms (1). Non-ferrous metals do not rust (1) so the aesthetic of the jewellery can remain even in damp conditions (1). Note: do not accept answers that relate to non skin sensitivity.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1c [2]	2
				Total	20

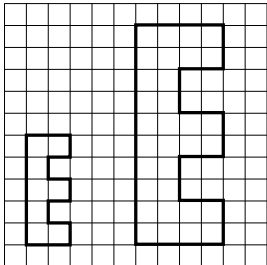
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (a) (i)			<p>Study the images below showing an electric cargo bike and its accessories. Select one product to refer to when answering the questions (a) to (c) if appropriate. Place a tick (✓) in the box of your selected product.</p> <p>State one specific material suitable for the product selected. [1]</p> <p>For example: Wooden container: Beech wood Metal bike frame: Mild steel; aluminium Battery pack: Polypropylene; ABS Plastic child's seat: Polypropylene Cardboard game: Card/Cardboard, folding boxboard Fabric head support: Cotton (knitted), polyester (knitted and brushed)</p> <p><i>Credit any other appropriate material.</i></p>	AO4 1a [1]	1

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>Evaluate the suitability of the material in (i) opposite for the product selected. [3]</p> <p>One mark for each suitable property/characteristic, awarding a maximum of two marks. Three marks to be awarded for properties/characteristics that have been explained and can relate to the material chosen.</p> <p>For example: Polypropylene is tough (1) and waterproof (1) so can easily be wiped clean and will not be damaged by children's use (1).</p> <p>For example: <u>Wooden container:</u> Beech wood – very hard; tough; good strength; abrasion resistant; attractive aesthetic; can be finished to protect from shrinkage. <u>Metal bike frame:</u> Steel – good tensile strength; tough; durable; can be finished to protect from corrosion and can be finished any colour. <u>Battery pack:</u> ABS – good balance of impact, heat, chemical and abrasion resistance; dimensional stability; tensile strength, surface hardness and rigidity. Is available in heat and fire-resistant grades, electrical insulator. <u>Plastic child's seat:</u> Polypropylene – good tensile strength; lightweight; chemical resistant; fatigue resistant; tough; durable; rigid. Can be made any colour; waterproof and can be easily wiped clean. <u>Cardboard game:</u> Cardboard – easy to fold, cut and print; rigid; can be laminated to protect print. <u>Fabric head support:</u> Cotton – absorbent; easily washed; durable; hyper allergenic; comfortable/soft; easily dyed.</p> <p>Note: Award marks for properties that relate correctly to answer provided in 5(a)(i) even if material provided is unsuitable or incorrect; do not double penalise.</p> <p><i>Credit any other appropriate response.</i></p>	AO3 2b [3]	3

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b) (i)			<p>Identify two anthropometric considerations for your chosen product. [2]</p> <p>Anthropometrics is the study of the sizes of people in relation to products. It uses measurements of parts of the human body to determine the size and shape of a product. Answers provided should relate to appropriate body parts and measurements for the product selected in 5(a). One mark for each correct response up to a maximum of 2 marks.</p> <p>Examples: <u>Wooden container</u>: any measurement relating to bike frame which has taken account of body measurements: any measurement relating to a child body frame is an acceptable answer. <u>Metal bike frame</u>: any measurement relating to a human adult's body frame will be an acceptable answer. <u>Battery pack</u>: measurements relating to hand/grip and reference to position in bike frame is an acceptable answer. <u>Plastic child's seat</u>: any measurement referencing a child body frame will be accepted. <u>Cardboard game</u>: measurement relating to hand size/grip most suitable answer. <u>Fabric head support</u>: measurements relating to neck size, hand width/grip most suitable answer.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>Evaluate the ergonomic design of your chosen product [4]</p> <p>Answers can relate to any aspect of ergonomic design to include appearance and anthropometrics but must be appropriate to the product chosen by the candidate and an evaluative response (advantages and disadvantages) about the product is given. Each advantage and/or disadvantage should be awarded 1 mark. Each advantage and/or disadvantage should be justified and linked to the product chosen. A maximum of 2 marks can be awarded for just listing advantages/disadvantages without justification/reasoning.</p> <p>For example: <u>Wooden container:</u> The wooden container is a suitable shape (1) to fit two children/seats in comfortably (1). The container has a curved aesthetic appearance (1) that would attract attention (1) and has a door (1) for easy access (1). However, candidates may mention children's fingers could get caught in the hinging of the door/handle (1). <u>Metal bike frame:</u> Bike is balanced ergonomically as it has three wheels (1). Handle bar is at the correct height (1) to support posture (1). Seat height can be changed (1) to be suitable for a range of adult heights (1). Vintage aesthetic and neutral colour (1). Pedal width and length (1) ergonomically designed for efficiency (1). <u>Battery pack:</u> Size of battery pack has been ergonomically designed to fit into hand (1) and a size that allows for easy battery removal ready for charging (1). Colour chosen for discreetness so can't be seen when in situ (1) and it matches the colour of the bike (1) <u>Plastic child's seat:</u> Moulded shape to be ergonomic (1) which adds comfort to the child when in use (1) and supports their body (1). Height at which the seats are positioned (1) is suitable and supportive for adults to securely fasten child (1). Colours chosen could be seen to be gender biased (1). Seat belts are ergonomically positioned (1) so children can fasten themselves (1). <u>Cardboard game:</u> Box is a cumbersome size and shape to be held in the hand securely by a child (1). Cards are of suitable size and shape for small children to play with (1) as can be picked up by small hands (1). Colour could be seen as bland (1) and not vibrant or draw attention to children's interests (1).</p>	AO3 2b [3] AO4 1a [1]	4

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
			<p><u>Fabric head support:</u> Economically designed to fit around a child's neck for support (1), the correct length and width has been anthropometrically calculated (1) so as not to suffocate the child (1). Colours used are suitable for a child (1) and do not denote gender (1).</p> <p><i>Credit any other appropriate response.</i></p>		
(c) (i)			<p>The designer undertakes a disassembly activity by taking apart a competitor's product before designing the electric cargo bike. Describe how disassembly can be a useful activity to a designer. [4]</p> <p>Award 1 mark for each reason that identifies the usefulness of disassembly as a design activity up to a maximum of two marks. Up to 2 marks can be awarded for clarity of description.</p> <p>For example:</p> <ul style="list-style-type: none"> • A designer can see how a competitor's product is made (1) and can improve their own product(s) by learning from the disassembly process (1) improving a products function and/or aesthetic (1) • By disassembling a product, a designer can see which materials (1) and components have been used (1) • Disassembly can help a designer to improve the sustainability of a product (1) so parts of the product can be recycled or reused (1) • Disassembly challenges better and improved designing (1) <p><i>Credit any other appropriate response.</i></p>	AO4 1c [1] AO4 2a [3]	4

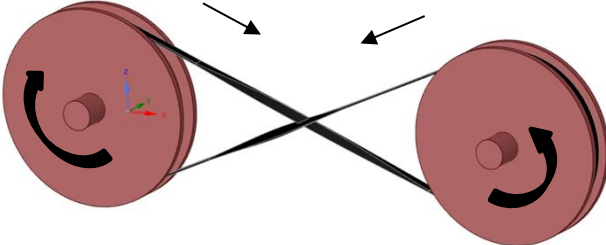
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>Write a design brief for the electric cargo bike that reflects its function. [2]</p> <p>The design brief must be written as a clear intent and not one that references or includes specification criteria. The function of the cargo bike must be clearly evident.</p> <p>For example: Design and make/create/manufacture (1) a bike that can carry two children (1) Design and make/create/manufacture (1) a bike that is safe for children to be transported in (1) Design and make/create/manufacture (1) a bike that is powered by electricity for ease of transporting the weight of children (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	2
(d) (i)		3	<p>The company that manufactures the electric cargo bike wants to rebrand all their products by adding a logo based on the letter E. Using the squared grid below, redraw the letter E shown, so that its area is four times greater. [3]</p>  <p>Mark allocation can be made up from: Correct height (10 squares) (1) Correct width (4 squares) (1) Correct depth (2 squares) (1) Correct 4 times greater (1)</p> <p><i>Mark allocation cannot be changed.</i></p>	AO4 1b [2] AO4 1c [1]	3

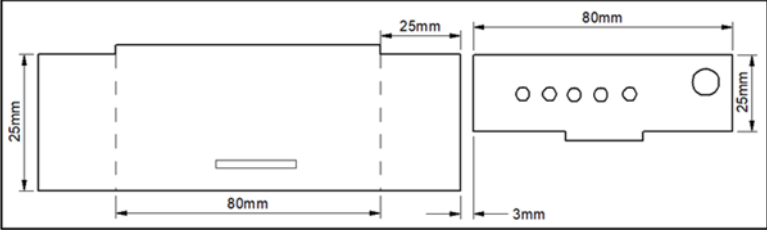
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)		1	<p>If the area of one square is equal to 5cm^2 calculate the total area of the letter E you have drawn. [1]</p> <p>Award one mark for calculating the area <i>if correct to the E drawn even if it has been drawn incorrectly</i> from that shown in 5 (d)(i).</p> <p>Answer: $5\text{cm}^2 \times 32\text{cm}^2 = 160\text{cm}^2$ (1)</p>	AO4 1c [1]	1
				Total	20

Section B

Question 6: Electronic systems, programmable components and mechanical devices.

Q	Science	Maths	Electronic systems, programmable components and mechanical devices. Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			<p>The picture below shows an eight-pin IC (integrated circuit) on a circuit board. State the purpose of the notch circled in the picture. [1]</p> <p>For example: To fit the integrated circuit chip the right way in its holder. (1) To indicate which pin is the first pin. (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1a [1]	1
(ii)			<p>Identify one reason for the colour bands on the resistors. [1]</p> <p>For example: Gives the value of the resistors. (1) Indicates the tolerance of the resistor (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1]	1
(iii)			<p>Explain the benefits of using printed circuit boards in the manufacture of modern electronic equipment. [2]</p> <p>Up to 2 marks can be awarded for a clear explanation of the benefits of using printed circuit boards in the manufacture of electronic components. One mark can be awarded for each correct reason provided up to a total of 2 marks.</p> <p>Responses could be based upon:</p> <ul style="list-style-type: none"> • A PCB is a simple platform to arrange the electronic components in a compressed and efficient way. (1) This compactness allows the creation of complex electronic circuits which take less space in devices. (1) • The conventional method of circuit connections takes much time to connect the components. (1) PCB's take less time in assembling a circuit (1) • Mass production can be achieved at lower cost. (1) This is not possible with conventional method of circuit connections. (1) <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	2

Q	Science	Maths	Electronic systems, programmable components and mechanical devices. Question or outline of question / Marking scheme	AO	Total
(iv)			<p>The image below shows an industrial piece of equipment used to create holes in the circuit board. State the correct name of the equipment. [1]</p> <p><i>Only acceptable answers for this piece of equipment: bench drill or pillar drill</i></p>	AO4 2c [1]	1
(v)			<p>The image below shows a simple pulley system. In the space below, use notes and sketches to show how the pulleys can be modified to turn at the same speed and in opposite directions. [4]</p> <p>Award up to 4 marks for answers that include both sketches and annotations/labelling that could include:</p> <ul style="list-style-type: none"> • A drawing with two pulleys that are the same size (1) • The pulley belt twisted as shown in the diagram below (1) • The direction arrows showing the driver pulley rotating in a clockwise direction (1) • The direction arrows showing the driven pulley rotating in an anti-clockwise direction (1) • Labels showing the motor driver pulley and driven pulley (1) <p>For example:</p> <p>Driver pulley Driven pulley</p>  <p><i>Credit any other appropriate response.</i></p>	AO4 2c [4]	4

Q	Science	Maths	Electronic systems, programmable components and mechanical devices. Question or outline of question / Marking scheme	AO	Total
(b) (i)		2	<p>The measurements of a circuit board housing are shown below. Calculate the minimum length of Side A to manufacture one circuit board housing. Select your final answer by correctly circling one of the measurements provided below. Show all workings. [2]</p>  <p>One mark awarded for the correct answer selected: 213mm (1) One mark to be awarded for correct calculation: 25mm + 80mm + 25mm + 3mm + 80mm (1)</p>	AO4 1b [3] AO4 1c [2]	5
(ii)		3	<p>The manufacturer decides to laser cut the LED support. Calculate how many LED support pieces can be cut from a sheet of plastic that measures 200cm x 90cm. Show all workings. [3]</p> <p><i>Calculation:</i></p> <p>200/8cm = 25 LED support pieces (1) 200/2.5cm = 80 support pieces (1) 90/2.5cm = 36 LED support pieces (1) OR 90/8cm = 11.25 = 11 support pieces (1) 25 x 36 = 900 LED support pieces (1) 80 x 11 = 880 LED support pieces (1)</p> <p><i>Credit any other appropriate approach to this calculation.</i></p>		

Q	Science	Maths	Electronic systems, programmable components and mechanical devices. Question or outline of question / Marking scheme	AO	Total															
(c)			<p>The circuit boards are manufactured in an economically developing country. Analyse how a designer can ensure that the circuit boards are manufactured in an ethical and environmentally friendly way. [5]</p> <p>To achieve Band 3 candidates must cover both ethical and environmental considerations.</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="400 528 1771 1059"> <thead> <tr> <th colspan="3" data-bbox="400 528 1771 571">AO3 2a 5 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="400 571 562 740">BAND 3</td> <td data-bbox="562 571 1666 740">Answers must cover both ethical and environmental areas. A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure that the circuit boards are produced in an environmental and ethical way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1666 571 1771 740">4-5</td> </tr> <tr> <td data-bbox="400 740 562 879">BAND 2</td> <td data-bbox="562 740 1666 879">Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure that the circuit boards are produced in an environmental and ethical way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1666 740 1771 879">2-3</td> </tr> <tr> <td data-bbox="400 879 562 1018">BAND 1</td> <td data-bbox="562 879 1666 1018">Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure that the circuit boards are produced in an environmental and ethical way. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td data-bbox="1666 879 1771 1018">1</td> </tr> <tr> <td colspan="3" data-bbox="400 1018 1771 1059">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p>Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below.</p> <p><i>Environmental Considerations:</i></p> <ul data-bbox="400 1225 1771 1428" style="list-style-type: none"> • A sustainable design and structure of PCB products in the beginning phase prevents material wastage. Ensuring lay planning is used to minimise wasting materials on cutting. • The use of lead-free solder or adhesives instead of lead-based solders is more environmental-friendly when soldering components to a circuit board. • The use of a press-fit method of connecting components to the circuit board. This mechanical method of joining the components to the circuit board does not require solder. 	AO3 2a 5 marks			BAND 3	Answers must cover both ethical and environmental areas. A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure that the circuit boards are produced in an environmental and ethical way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure that the circuit boards are produced in an environmental and ethical way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure that the circuit boards are produced in an environmental and ethical way. There will be limited evidence of relevant examples or a logical chain of reasoning.	1	Award 0 marks for incorrect or irrelevant answers			AO3 2a [5]	5
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Award 0 marks for incorrect or irrelevant answers																				

Q	Science	Maths	<p style="text-align: center;">Electronic systems, programmable components and mechanical devices.</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
			<ul style="list-style-type: none"> • Recycling components from older circuit boards can reduce harm to the ecosystem. • By minimising the size of the circuit board. Smaller boards require less material and use less energy. Applying this consistently can have a significant impact over time. • Select local manufacturing plants which reduces pollution that results from transportation of materials. • Ensure circuit boards are manufactured with quality so they function well and last long. • The use of additive processes that print conductive materials to paper and fabrics, the introduction of a paper PCB (P-PCB) could offer significant environmental benefits. • Using printing technology – several process steps involving considerable material consumption, such as etching and cleaning, are substituted with a single process consisting of adding material to the substrate. Materials can be easily separated and recycled. • The use of Reactive Nano Technologies (RNT) an innovative approach to do the soldering process using low energy consumption. This process produces sufficient thermal energy to solder components on the board. <p><i>Ethical Considerations:</i></p> <ul style="list-style-type: none"> • The WEEE Directive (2012/19/EU) aims to reduce the amount of waste electrical and electronic equipment that ends up in landfill. • Practices to safe guard the health and well-being of employees are implemented. • Pay is fair and employees work acceptable hours, with breaks and in well ventilated, healthy environments. • Workers have contracts ensuring regular income. • No child labour/exploitation of workers. • Ethically sourced raw materials. <p><i>However:</i></p> <ul style="list-style-type: none"> • The methods and innovations suggested above might seem more environmental-friendly, but they still do not solve the problem of mechanical recycling. <p><i>Credit any other appropriate response.</i></p>		

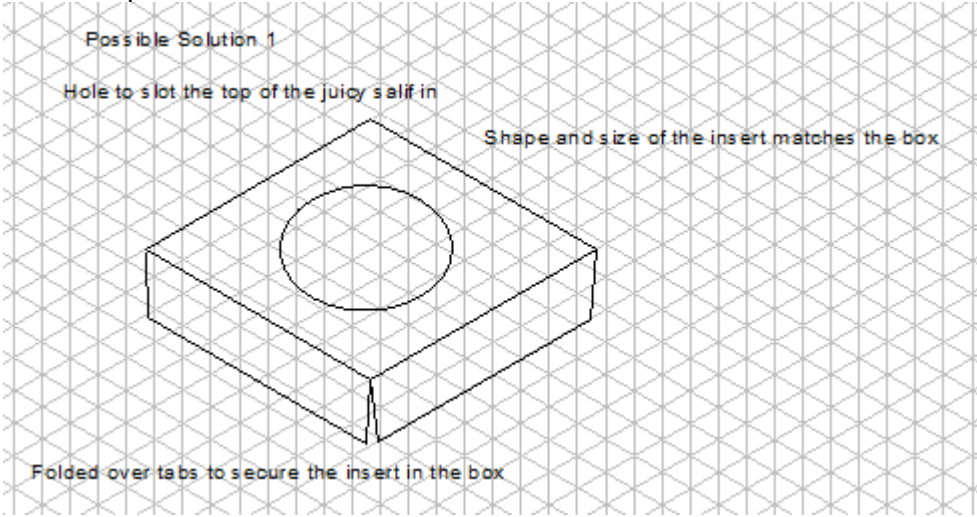
Q	Science	Maths	Electronic systems, programmable components and mechanical devices. Question or outline of question / Marking scheme	AO	Total															
(d)			<p>A prototype circuit board is tested and evaluated during the process of designing and making. Evaluate the need for testing and evaluating. [6]</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="400 472 1771 992"> <thead> <tr> <th colspan="3" data-bbox="400 472 1771 515">AO3 2b 6 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="400 515 562 659">BAND 3</td> <td data-bbox="562 515 1668 659">A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td> <td data-bbox="1668 515 1771 659">5-6</td> </tr> <tr> <td data-bbox="400 659 562 802">BAND 2</td> <td data-bbox="562 659 1668 802">Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td> <td data-bbox="1668 659 1771 802">3-4</td> </tr> <tr> <td data-bbox="400 802 562 946">BAND 1</td> <td data-bbox="562 802 1668 946">Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td> <td data-bbox="1668 802 1771 946">1-2</td> </tr> <tr> <td colspan="3" data-bbox="400 946 1771 992">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p>Indicative content</p> <p>This content is not prescriptive and candidates are not expected to refer to all the material identified below.</p> <p><i>The usefulness of testing and evaluating:</i> Ensures the circuit board:</p> <ul data-bbox="400 1235 1771 1410" style="list-style-type: none"> • Meets the design specification criteria written by the designer. • Meets the demands of the manufacturing specification. • The primary benefit of PCB testing is that it helps identify problems in PCBs. The tests help to identify issues with the PCB for example, functionality and manufacturability. This helps the designer to adjust accordingly. 	AO3 2b 6 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
AO3 2b 6 marks																				
BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6																		
BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4																		
BAND 1	Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2																		
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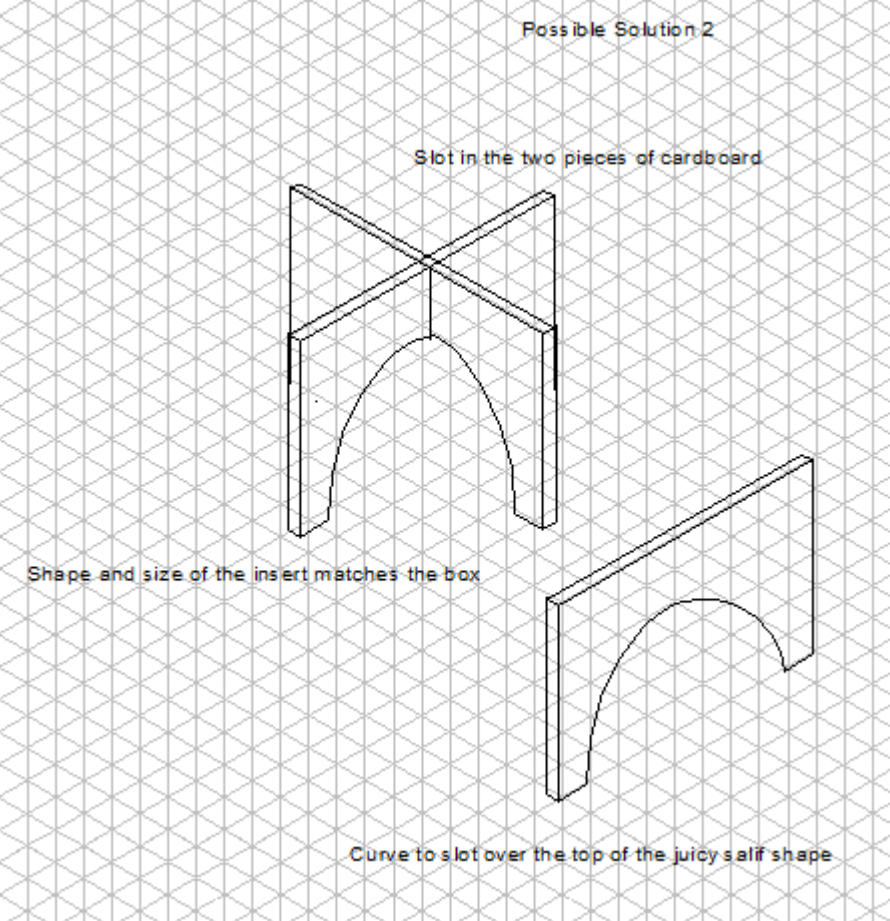
Q	Science	Maths	<p>Electronic systems, programmable components and mechanical devices.</p> <p>Question or outline of question / Marking scheme</p>	AO	Total
			<ul style="list-style-type: none"> • PCB testing in the early stages can help save time in the long run, allowing designers to identify major issues during the prototyping stage. • Testing enables designers to determine the root cause of each problem posed quickly and easily, making adjustments so that they can move on with production at a faster rate and reduce product lead-time. • PCB testing prevents wasteful production of faulty products by using prototypes and small-scale assemblies to test the products. By completing thorough testing early in the design process, designers can prevent wasteful full-scale assemblies of faulty PCBs, ensuring that the design is as flawless as possible before it goes into production. • When companies conduct PCB testing, they lower the chances of selling defective products or those that don't meet performance standards. As a result, they don't see as many returned products, leading to reduced costs associated with refunding customers and handling defective goods. • Since PCBs are often used in essential electronic technologies, their failure can cause major issues for a company's productivity or an organization's ability to perform essential services. A defective PCB could cause a fire, potentially putting those near it in danger. Testing prior to manufacturing can also ensure machines and workers aren't damaged or injured due to an improper design during production. • Test runs on prototypes or small-scale assemblies, look most closely at potential shorts, solder joint issues and functionality, ensuring that each tested PCB will function as intended. <p><i>However:</i></p> <ul style="list-style-type: none"> • Testing and evaluating can extend the length of time the product takes to arrive to the customer. • Testing and evaluating may add to the retail cost of the product as it is involving additional processes and requires skilled labour/training involvement. • Without testing and evaluating, the product may be returned by the consumer as not fit for purpose or as advertised. This has financial consequences for both the retailer and the manufacturer. • Testing is not always undertaken at the manufacturing plant. The circuit board may need to be transported to another company for testing, prolonging lead time. <p><i>Credit any other appropriate response.</i></p>		

Question 6: Papers and boards

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			<p>The picture below shows packaging of Phillippe Starck’s iconic product the Juicy Salif made by Alessi.</p> <p>The packaging has a shiny gloss finish. State the method used to create the shiny gloss finish on the packaging [1]</p> <p>Accept: varnishing, UV varnishing or lamination.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1a [1]	1
(ii)			<p>Identify one benefit of applying a shiny gloss finish. [1]</p> <p>Award 1 mark for any of the following responses</p> <ul style="list-style-type: none"> • It improves the aesthetics of the packaging • It adds sophistication to the product • Helps to protect the packaging from general wear through handling • The UV protects the product from being scratched/damaged. <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1]	1

Q	Science	Maths	Papers and boards	AO	Total
			Question or outline of question / Marking scheme		
(iii)			<p>The packaging is designed to include tabs. Explain why tabs are used in the construction of the packaging. [2]</p> <p>Up to 2 marks can be awarded for a clear explanation as to why tabs are used in the construction of the packaging. One mark can be awarded for each correct reason provided up to a total of 2 marks.</p> <p>Responses could be based upon:</p> <ul style="list-style-type: none"> • The packaging tabs help in the assembly during manufacturing providing ease of putting it together (2) • Tabs provide the ability to open and close the packaging (1) making it easier for the consumer (1) • Tabs enable the product to be flat packed more effectively (1) aiding the manufacturer with transport and distribution (1) <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	2
(iv)			<p>The image below shows graphics equipment used to create a clean, sharp fold in the packaging nets. State the name of the equipment. [1]</p> <p><i>Only acceptable answers for this piece of equipment: Creasing tool/bone folder.</i></p>	AO4 2c [1]	1

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
(v)			<p>The image below shows the packaging box for the Juicy Salif.</p> <p>In the space below use annotated sketches to design a cardboard insert to stop the Juicy Salif from moving around when it is in the packaging box. [4]</p> <p>Award up to 4 marks for answers that include both sketches and annotations/labelling. Answers could reference:</p> <ol style="list-style-type: none"> 1. The insert should fit the size and shape of the packaging box. 2. The insert should secure the Juicy Salif in position. 3. The candidate could show how the insert is constructed and used e.g., slotted together or show the use of folded over tabs. 4. The insert could be made from sheet cardboard. <p>For example:</p> 	AO4 2c [4]	4

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
			<p data-bbox="913 316 1111 338">Possible Solution 2</p>  <p data-bbox="808 448 1160 470">Slot in the two pieces of cardboard</p> <p data-bbox="421 866 875 888">Shape and size of the insert matches the box</p> <p data-bbox="741 1145 1227 1168">Curve to slot over the top of the juicy salif shape</p> <p data-bbox="1720 1203 1816 1225">4 marks</p> <p data-bbox="398 1270 898 1292"><i>Credit any other appropriate response.</i></p>		

Q	Science	Maths	Papers and boards	AO	Total
			Question or outline of question / Marking scheme		
(b) (i)		2	<p>Measurements for the packaging net are shown below.</p> <p>Calculate the minimum length material to manufacture Side A of the packaging net.</p> <p>Select your final answer by circling one of the measurements provided below. Show all workings. [2]</p> <p>520mm <u>540mm</u> 560mm 630mm</p> <p>One mark awarded for the correct answer selected: 540mm (1) One mark to be awarded for correct calculation: $130\text{mm} + 90\text{mm} + 300\text{mm} + 20\text{mm}$ (1)</p>	AO4 1b [3] AO4 1c [2]	5
(ii)		3	<p>The manufacturer decides to print a four-fold leaflet to insert in the packaging. The measurements for the front of the leaflet are shown below.</p> <p>Calculate how many leaflets can be printed from a sheet that measures 1 metre x 1 metre. Show all workings. [3]</p> <p><i>Calculation:</i> Size of Leaflet $80 \times 4 = 320$ – overall size 320×250 (1)</p> <p>1 metre = 1000mm $1000/320 = 3.1$ $1000/250 = 4$ (1)</p> <p>Answer: $3 \times 4 = 12$ (1)</p> <p><i>Credit any other appropriate approach to this calculation.</i></p>		

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total															
(c)			<p>The packaging is manufactured in an economically developing country. Analyse how a designer can ensure the packaging is produced in an ethical and environmentally friendly way. [5]</p> <p>To achieve Band 3 candidates must cover both ethical and environmental considerations.</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="394 536 1767 1090"> <thead> <tr> <th colspan="3" data-bbox="394 536 1767 579">AO3 2a 5 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="394 579 555 722">BAND 3</td> <td data-bbox="555 579 1659 722">A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the packaging is produced in an ethical and environmentally friendly way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1659 579 1767 722">4-5</td> </tr> <tr> <td data-bbox="394 722 555 903">BAND 2</td> <td data-bbox="555 722 1659 903">Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the packaging is produced in an ethical and environmentally friendly way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1659 722 1767 903">2-3</td> </tr> <tr> <td data-bbox="394 903 555 1046">BAND 1</td> <td data-bbox="555 903 1659 1046">Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the packaging is produced in an ethical and environmentally friendly way. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td data-bbox="1659 903 1767 1046">1</td> </tr> <tr> <td colspan="3" data-bbox="394 1046 1767 1090">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p>Indicative content</p> <p>This content is not prescriptive and candidates are not expected to refer to all the points identified below.</p> <p><i>Environmental Considerations:</i></p> <ul data-bbox="394 1299 1503 1401" style="list-style-type: none"> • Using cardboard that has been recycled previously • Using printing ink and/or glues from natural origins and/or those that are non-toxic • Reducing manufacturing processing, for example, simplifying packaging design 	AO3 2a 5 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the packaging is produced in an ethical and environmentally friendly way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the packaging is produced in an ethical and environmentally friendly way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the packaging is produced in an ethical and environmentally friendly way. There will be limited evidence of relevant examples or a logical chain of reasoning.	1	Award 0 marks for incorrect or irrelevant answers				
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Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
			<ul style="list-style-type: none"> • Ensuring waste products are disposed of correctly and safely • Use manufacturing plants that are powered by renewable energy sources such as solar power • Ensuring effective nesting to minimise wasting materials on cutting (and discarded) • Select local manufacturing plants reducing transportation costs and the pollution that results • Ensure raw materials are processed in the same country that is to manufacture them (reducing pollution from excess transportation) • Consider the fuel used to transport raw materials and the packaging to the retailer • Ensure all parts of the packaging is recyclable • Ensure packaging is manufactured with quality so it functions well and will last to protect the product if required • Undertake a Life-Cycle analysis when designing the product • Packaging is designed with a circular economy approach. <p><i>Ethical Considerations:</i></p> <ul style="list-style-type: none"> • Cultural awareness and local practices are not prohibited based on manufacturing demands • Practices to safe guard the health and well-being of employees are implemented • Pay is fair and employees work acceptable hours, with breaks and in well ventilated, healthy environments • Workers have contracts ensuring regular income • No child labour/exploitation of workers • Ethically sourced raw materials. <p><i>However:</i></p> <ul style="list-style-type: none"> • Many of the resources e.g., natural inks, paying a fair wage to the workforce, will increase the selling price of the packaging • Packaging can be discarded immediately by the consumer and may not be recycled • Consumers tend to purchase the product without thinking about the ethical and environmental factors/considerations of the packaging the product is being sold in. <p><i>Credit any other appropriate response.</i></p>		

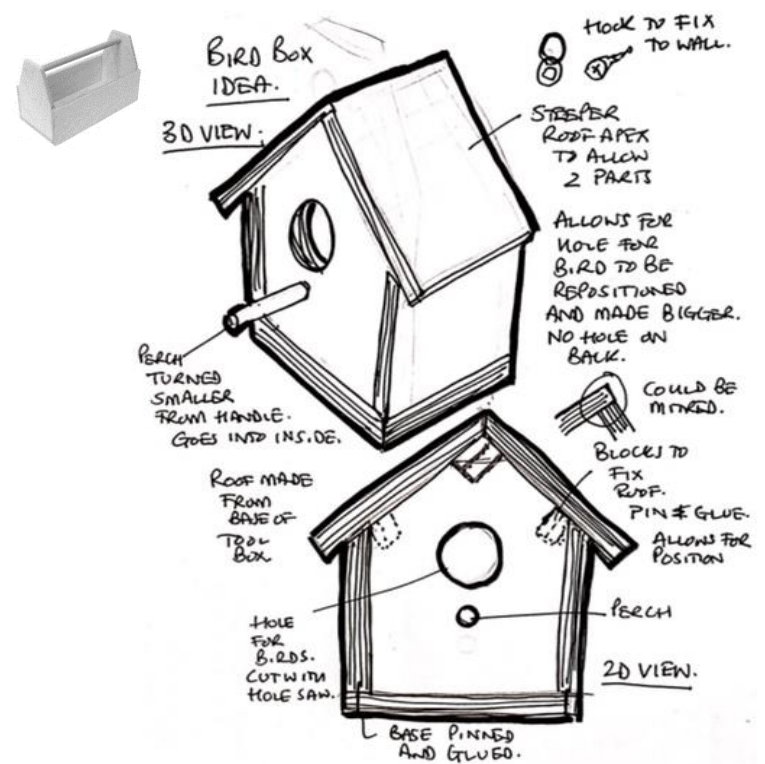
Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total															
(d)			<p>A prototype of the packaging is tested and evaluated during the process of designing and making.</p> <p>Evaluate the need for testing and evaluating. [6]</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="394 501 1767 1023"> <thead> <tr> <th colspan="3" data-bbox="394 501 1767 544">AO3 2b 6 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="394 544 555 691">BAND 3</td> <td data-bbox="555 544 1659 691">A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td> <td data-bbox="1659 544 1767 691">5-6</td> </tr> <tr> <td data-bbox="394 691 555 837">BAND 2</td> <td data-bbox="555 691 1659 837">Answer has some coherence, demonstrating partial knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td> <td data-bbox="1659 691 1767 837">3-4</td> </tr> <tr> <td data-bbox="394 837 555 984">BAND 1</td> <td data-bbox="555 837 1659 984">Answer demonstrates only basic knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td> <td data-bbox="1659 837 1767 984">1-2</td> </tr> <tr> <td colspan="3" data-bbox="394 984 1767 1023">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p>Indicative content</p> <p>This content is not prescriptive and candidates are not expected to refer to all the material identified below.</p> <p><i>The usefulness of testing and evaluating:</i></p> <p>Ensures the packaging:</p> <ul style="list-style-type: none"> • Meets the design specification criteria written by the designer • Meets the demands of the manufacturing specification • Is made with quality throughout • Fits the target market as expected 	AO3 2b 6 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers				
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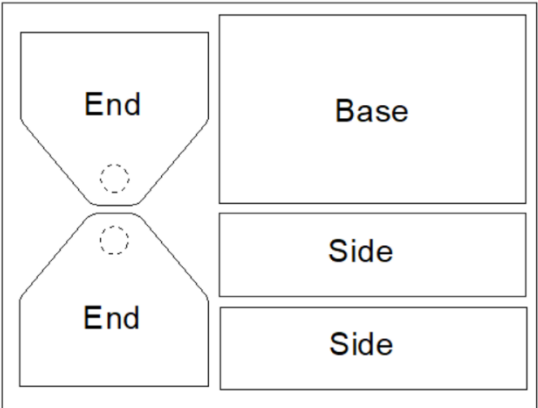
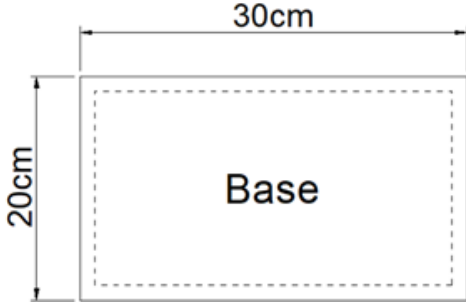
Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
			<ul style="list-style-type: none"> • Withstands the demands of ‘wear and tear’, for example, able to put the product back in for storage in its box if required by the consumer • Meets the demands of the target market and acts as a selling point to the product • Quality control ensures high quality, e.g., ink colour CYMK, accuracy of printing tests • Strength of the material to ensure the packaging protects its product. <p><i>However:</i></p> <ul style="list-style-type: none"> • Testing and evaluating may add to the retail cost of the product as it is involving additional processes and requires skilled labour/training involvement • Without testing and evaluating, the product may be returned by the consumer should the packaging become damaged and therefore the product is damaged. This has financial consequences for both the retailer and the manufacturer. <p><i>Credit any other appropriate response.</i></p>		
				Total	25

Question 6: Natural and manufactured timber

Q	Science	Maths	<p style="text-align: center;">Natural and manufactured timber</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
6. (a) (i)			<p>The picture below is of a wooden toolbox that has been surface treated. State a suitable finish used to protect the toolbox. [1]</p> <p><i>Acceptable answers for finish to protect the toolbox: wood stain, oil, varnish, lacquer or wax.</i></p> <p><i>Credit any other appropriate response.</i></p>	AO4 1a [1]	1
(ii)			<p>Identify the material used to create the panels of the toolbox. [1]</p> <p>Answer: Plywood.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1]	1
(iii)			<p>The toolbox is constructed using pins and glue. Explain why pins and glue are used in the construction of the toolbox. [2]</p> <p>Up to 2 marks can be awarded for a clear explanation as to why pins and glue are used in the construction of the toolbox. One mark can be awarded for each correct reason provided up to a total of 2 marks.</p> <p>Responses could be based upon:</p> <ol style="list-style-type: none"> 1. Permanent method of fixing the toolbox together, creating a strong joint. This allows for the weight of the tools being stored in the box 2. Allow for the thickness of the material used. The thickness will allow the pins to be hammered in and prevent splitting the panel 3. A pilot hole will need to be drilled for the nail to allow the head to line up with the wooden pieces that require fixing together. It will also allow the nail to enter the panel straight and prevent it splitting 4. PVA wood glue is then added, and the panel pin added after the surfaces are glued. This adds strength to the wood joint. The glue is added before the nail is added and adds strength to the joint 5. When the panel pin is hammered into the wood a nail punch is used to get the nail below the surface so that a finish can be added, and the nail is below the surface. <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	2

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
(iv)			<p>The image below shows a piece of equipment used to mark out the panels of the toolbox.</p> <p>State the name of the piece of equipment shown. [1]</p> <p><i>Only acceptable answers for this piece of equipment: Try square.</i></p>	AO4 2c [1]	1
(v)			<p>When the toolbox is unsuitable for use, it will be recycled. In the space below, use words and sketches to show how the toolbox can be cut and finished to create a simple bird box. [4]</p> <p>Award up to 4 marks for answers that include both sketches and annotations/labelling.</p> <p>For example: handle used and cut into short lengths attached for a perch for a bird to use. This could also be turned down to a smaller diameter. The ends of the toolbox could be used to create the front and back, the rest of the plywood used to create the sides and base. The roof apex changed to allow for a bigger hole for the birds and no hole on the back.</p> <p><i>Credit any appropriate response.</i></p>	AO4 2c [4]	4



Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
(b) (i)		2	<p>Measurements for the toolbox are shown below with the plan of the templates used to make the panels of the toolbox.</p> <p>Calculate the minimum length of Side A to manufacture one toolbox. Select the correct answer by circling one of the measurements provided below. Show all workings. [2]</p> <p style="text-align: center;"> 53cm 60cm 63cm 75cm </p> <p>One mark awarded for the correct answer selected: 53cm (1)</p> <p>One mark to be awarded for correct calculation: $30\text{cm} + 20\text{cm} + 3\text{cm}$ (allowance for cutting) = 53cm (1)</p> <p><i>Credit any appropriate calculation process.</i></p>	AO4 1b [3] AO4 1c [2]	5
(ii)		3	<p>The manufacturer cuts the toolbox base from a different thickness of material. Calculate how many bases can be cut from a standard sized sheet that measures 244cm x 122cm. Show all workings. [3]</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 10px; margin-right: 20px;">  </div> <div style="text-align: center;"> <p>Allow 1cm between parts for cutting</p>  </div> </div> <p>The answer for this calculation will vary depending upon if the plywood is cut horizontally or vertically. Allowance for cutting must be included. Accept either calculation process.</p>		

Q	Science	Maths	<p style="text-align: center;">Natural and manufactured timber</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total															
			<p><i>Horizontal or Vertical Calculation:</i> Plywood pieces are 31cm x 21cm (Includes allowance for cutting)</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> $244\text{cm}/31 = 7.8 = 7$ bases across length $122\text{cm}/21=5.8 = 5$ bases across width (1) 7×5 bases = 35 (1) Answer = 35 plywood bases (1) </td> <td style="width: 50%; border: none;"> $244\text{cm}/21 = 11.6 = 11$ bases across length $122\text{cm}/31 = 3.9 = 3$ bases across width (1) 11×3 bases = 33 (1) Answer = 33 plywood bases (1) </td> </tr> </table> <p><i>Credit any other appropriate approach to this calculation.</i></p>	$244\text{cm}/31 = 7.8 = 7$ bases across length $122\text{cm}/21=5.8 = 5$ bases across width (1) 7×5 bases = 35 (1) Answer = 35 plywood bases (1)	$244\text{cm}/21 = 11.6 = 11$ bases across length $122\text{cm}/31 = 3.9 = 3$ bases across width (1) 11×3 bases = 33 (1) Answer = 33 plywood bases (1)															
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(c)			<p>The toolbox is a low-cost product manufactured in an economically developing country. Analyse how a designer can ensure the toolbox is produced in an ethical and environmentally friendly way. [5]</p> <p>To achieve Band 3 candidates must cover both ethical and environmental considerations.</p> <p>Band descriptors and mark allocations</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: center;">AO3 2a 5 marks</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">BAND 3</td> <td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td style="text-align: center;">4-5</td> </tr> <tr> <td style="text-align: center;">BAND 2</td> <td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td style="text-align: center;">2-3</td> </tr> <tr> <td style="text-align: center;">BAND 1</td> <td>Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td style="text-align: center;">1</td> </tr> <tr> <td colspan="3">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table>	AO3 2a 5 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be limited evidence of relevant examples or a logical chain of reasoning.	1	Award 0 marks for incorrect or irrelevant answers			AO3 2a [5]	5
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Q	Science	Maths	<p style="text-align: center;">Natural and manufactured timber</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
			<p>Indicative content</p> <p>This content is not prescriptive, and candidates are not expected to refer to all the points identified below.</p> <p><i>Environmental Considerations:</i></p> <ul style="list-style-type: none"> • Using wood that is recyclable or easily biodegradable • Using wood that has been recycled previously • Ensuring the wood is from a sustainable source or managed forest • Using finishes from natural origins and/or those that are non-toxic • Ensuring waste products are disposed of correctly and safely • Use manufacturing plants that are powered by renewable energy sources such as solar power • Ensuring lay planning is used to minimise wasting materials on cutting (and discarded) • Select local manufacturing plants reducing transportation costs and the pollution that results • Ensure raw materials are grown and processed in the same country that is to manufacture them (reducing pollution from excess transportation) • Consider the fuel used to transport raw materials and the toolbox to the retailer • Reduce packaging and/or ensure packaging is recyclable • Is the toolbox necessary? Has the target market's needs and wants been considered so the toolbox will sell and not be discarded • Ensure toolbox is manufactured with quality so it functions well and will last • Undertake a Life-Cycle analysis when designing the product • Toolbox is designed with a circular economy approach. <p><i>Ethical Considerations:</i></p> <ul style="list-style-type: none"> • Cultural awareness and local practices are not prohibited based on manufacturing demands • Practices to safeguard the health and well-being of employees are implemented – from farmers to machinists • Pay is fair and employees work acceptable hours, with breaks and in well ventilated, healthy environments • Workers have contracts ensuring regular income • No child labour/exploitation of workers • Fairtrade – no producer is disadvantaged • Ethically sourced raw materials. <p><i>Credit any other appropriate response.</i></p>		

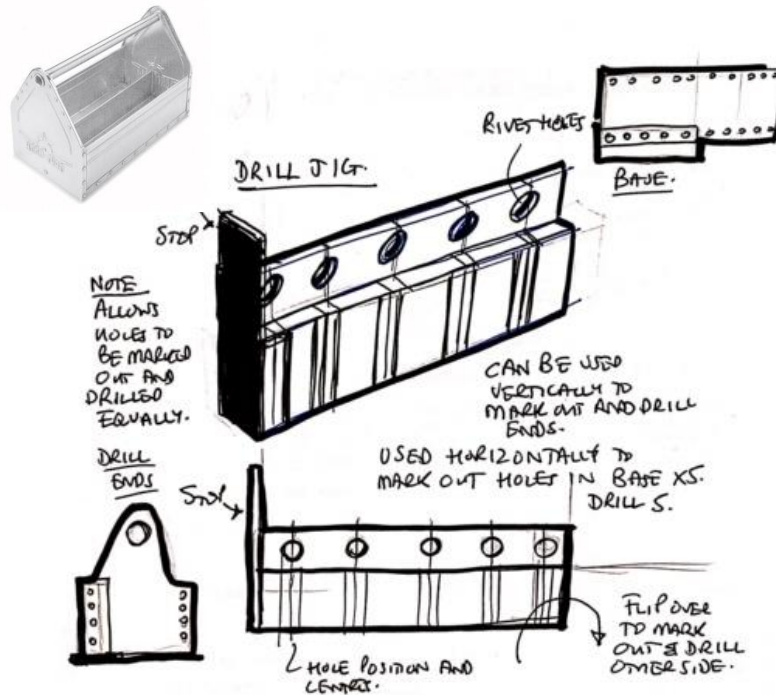
Q	Science	Maths	<p style="text-align: center;">Natural and manufactured timber</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total															
(d)			<p>A prototype toolbox is tested and evaluated during the process of designing and making.</p> <p>Evaluate the need for testing and evaluating. [6]</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="394 499 1794 1054"> <thead> <tr> <th colspan="3" data-bbox="394 499 1794 544">AO3 2b 6 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="394 544 555 687">BAND 3</td> <td data-bbox="555 544 1662 687">A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating a prototype in designing and making. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td> <td data-bbox="1662 544 1794 687" style="text-align: center;">5-6</td> </tr> <tr> <td data-bbox="394 687 555 863">BAND 2</td> <td data-bbox="555 687 1662 863">Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating a prototype in the process of designing and making. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.</td> <td data-bbox="1662 687 1794 863" style="text-align: center;">3-4</td> </tr> <tr> <td data-bbox="394 863 555 1007">BAND 1</td> <td data-bbox="555 863 1662 1007">Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating a prototype in the process of designing and making. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td> <td data-bbox="1662 863 1794 1007" style="text-align: center;">1-2</td> </tr> <tr> <td colspan="3" data-bbox="394 1007 1794 1054">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p>Indicative content</p> <p>This content is not prescriptive, and candidates are not expected to refer to all the material identified below.</p> <p><i>The usefulness of testing and evaluating a prototype during the process of designing and making:</i></p> <p>Ensures the toolbox:</p> <ul style="list-style-type: none"> • Meets the design specification criteria written by the designer • Meets the demands of the manufacturing specification • Is made with quality throughout 	AO3 2b 6 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating a prototype in designing and making. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating a prototype in the process of designing and making. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating a prototype in the process of designing and making. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
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Q	Science	Maths	<p style="text-align: center;">Natural and manufactured timber</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
			<ul style="list-style-type: none"> • Fits the target market as expected • Withstands the demands of daily 'wear and tear', for example the panels can withstand use • Can hold the weight of tools stored within it • Is durable and hard wearing due to construction and the finish applied to it • Meets the demands of the target market at that time • Dimensions and construction methods are suitable • Allows for changes to be made to the product prior to manufacture <p><i>Credit any other appropriate response.</i></p>		
				Total	25

Question 6: Ferrous and non-ferrous metals

Q	Science	Maths	<p style="text-align: center;">Ferrous and non-ferrous metals</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
6. (a) (i)			<p>The picture below is of a toolbox that has been fabricated from mild steel.</p> <p>State a surface treatment used to create a suitable finish on the toolbox. [1]</p> <p><i>Acceptable answers to create the finish on the toolbox:</i> polishing, clear lacquer, paint, dip coating.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1a [1]	1
(ii)			<p>Identify the process that has been used to create the panels of the toolbox. [1]</p> <p>Acceptable answers: die cutting, pressing, folding, punching and folding. Plasma laser cutting.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1]	1
(iii)			<p>The toolbox is constructed using rivets. Explain why rivets are used in the construction of the toolbox. [2]</p> <p>Up to 2 marks can be awarded for a clear explanation as to why pop rivets are used in the construction of the toolbox. One mark can be awarded for each correct reason provided up to a total of 2 marks.</p> <p>Responses could be based upon:</p> <ol style="list-style-type: none"> 1. The pop rivets provide a permanent join for the mild steel sheet 2. Neat finish that prevents discolouration of the metal if joined using a heat process 3. The holes are created on the folds of the materials, so the rivet joins each section together 4. Provides an industrial look, aesthetic 5. Heat processes may affect the shape of the toolbox and are therefore not as suitable 6. Quick and simple yet semi - permanent joint. <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	2

Q	Science	Maths	<p style="text-align: center;">Ferrous and non-ferrous metals</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
(iv)			<p>The image below shows a piece of equipment used to mark out the panels of the toolbox.</p> <p>State the name of the piece of equipment shown. [1]</p> <p><i>Only acceptable answer for this piece of equipment: odd leg calliper.</i></p>	AO4 2c [1]	1
(v)			<p>The toolbox requires several holes to be drilled for the panels to be riveted. In the space below, use notes and sketches to design a suitable drilling jig. [4]</p> <p>Award up to 4 marks for answers that include both sketches and annotations/labelling.</p> <p>For example: The example shown allows for 5 holes to be marked out ready for drilling. This allows the base to be marked out to the centre and then flipped to mark out the other side. A stop allows you to align the end of the mild steel. The centres and hole edges are marked on the jig to allow checking and scribing lines. The jig can also be used on the ends of the toolbox as there are 5 holes on each edge left and right.</p> <p>There will be other variations. If it is realistic and possible to use as a drilling jig award marks.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 2c [4]	4



Q	Science	Maths	<p style="text-align: center;">Ferrous and non-ferrous metals</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total		
(b) (i)		2	<p>Measurements for the toolbox are shown below with the plan of the templates used to make the panels of the toolbox.</p> <p>Calculate the minimum length of Side A needed to manufacture one toolbox. Select your final correct answer by circling one of the measurements provided below. Show all workings. [2]</p> <p style="text-align: center;">54cm 55cm 70cm 74cm</p> <p>One mark awarded for the correct answer selected: 55cm (1)</p> <p>One mark to be awarded for correct calculation: 30cm + 22cm + 3cm (Allowance for cutting) = 55cm (1)</p>	AO4 1b [3] AO4 1c [2]	5		
(ii)		3	<p>The manufacturer cuts the toolbox base from a separate sheet of mild steel. Calculate how many bases can be cut from a sheet of mild steel that measures 244cm x 122cm. Show all workings. [3]</p> <p>The answer for this calculation will vary depending upon if the mild steel is cut horizontally or vertically. Allowance for cutting must be included. Accept either method of calculation.</p> <p><i>Horizontal or Vertical Calculation:</i></p> <p>Mild steel pieces are 31cm x 21cm (Includes allowance for cutting)</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> $244\text{cm}/31 = 7.8 = 7$ bases across length $122\text{cm}/21=5.8 = 5$ bases across width (1) 7×5 bases = 35 (1) Answer = 35 mild steel bases (1) </td> <td style="width: 50%; vertical-align: top;"> $244\text{cm}/21 = 11.6 = 11$ bases across length $122\text{cm}/31 = 3.9 = 3$ bases across width (1) 11×3 bases = 33 (1) Answer = 33 mild steel bases (1) </td> </tr> </table> <p><i>Credit any other appropriate approach to this calculation.</i></p>	$244\text{cm}/31 = 7.8 = 7$ bases across length $122\text{cm}/21=5.8 = 5$ bases across width (1) 7×5 bases = 35 (1) Answer = 35 mild steel bases (1)	$244\text{cm}/21 = 11.6 = 11$ bases across length $122\text{cm}/31 = 3.9 = 3$ bases across width (1) 11×3 bases = 33 (1) Answer = 33 mild steel bases (1)		
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(c)			<p>The toolbox is a low-cost product manufactured in an economically developing country. Analyse how a designer can ensure the toolbox is produced in an ethical and environmentally friendly way. [5]</p> <p>To achieve Band 3 candidates must cover both ethical and environmental considerations.</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="398 531 1821 1018"> <thead> <tr> <th colspan="3" data-bbox="398 531 1821 576" style="text-align: center;">AO3 2a 5 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="398 576 562 719" style="text-align: center;">BAND 3</td> <td data-bbox="562 576 1688 719">A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1688 576 1821 719" style="text-align: center;">4-5</td> </tr> <tr> <td data-bbox="398 719 562 863" style="text-align: center;">BAND 2</td> <td data-bbox="562 719 1688 863">Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1688 719 1821 863" style="text-align: center;">2-3</td> </tr> <tr> <td data-bbox="398 863 562 975" style="text-align: center;">BAND 1</td> <td data-bbox="562 863 1688 975">Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td data-bbox="1688 863 1821 975" style="text-align: center;">1</td> </tr> <tr> <td colspan="3" data-bbox="398 975 1821 1018">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table>	AO3 2a 5 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the toolbox is produced in an environmental and ethical way. There will be limited evidence of relevant examples or a logical chain of reasoning.	1	Award 0 marks for incorrect or irrelevant answers			AO3 2a [5]	5
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Q	Science	Maths	<p style="text-align: center;">Ferrous and non-ferrous metals</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
			<p>Indicative content</p> <p>This content is not prescriptive, and candidates are not expected to refer to all the points identified below.</p> <p><i>Environmental Considerations:</i></p> <ul style="list-style-type: none"> • Using metal that is recyclable or can be easily reformed • Using metal that has been recycled previously • Ensuring the metal is from a sustainable source or managed mine/quarry, iron ore • Using finishes from natural origins and/or those that are non-toxic • Ensuring waste products are disposed of correctly and safely • Use manufacturing plants that are powered by renewable energy sources such as solar power • Ensuring lay planning is used to minimise wasting materials on cutting (and discarded) • Select local manufacturing plants reducing transportation costs and the pollution that results • Ensure raw materials are grown and processed in the same country that is to manufacture them (reducing pollution from excess transportation) • Consider the fuel used to transport raw materials and the toolbox to the retailer • Reduce packaging and/or ensure packaging is recyclable • Is the toolbox necessary? Has the target market's needs and wants been considered so the toolbox will sell and not be discarded? • Ensure toolbox is manufactured with quality so it functions well and will last • Undertake a Life-Cycle analysis when designing the product • Toolbox is designed with a circular economy approach. <p><i>Ethical Considerations:</i></p> <ul style="list-style-type: none"> • Cultural awareness and local practices are not prohibited based on manufacturing demands • Practices to safeguard the health and well-being of employees are implemented – from miners to machinists • Pay is fair and employees work acceptable hours, with breaks and in well ventilated, healthy environments • Workers have contracts ensuring regular income • No child labour/exploitation of workers • Fairtrade – no producer is disadvantaged • Ethically sourced raw materials. <p><i>Credit any other appropriate response.</i></p>		

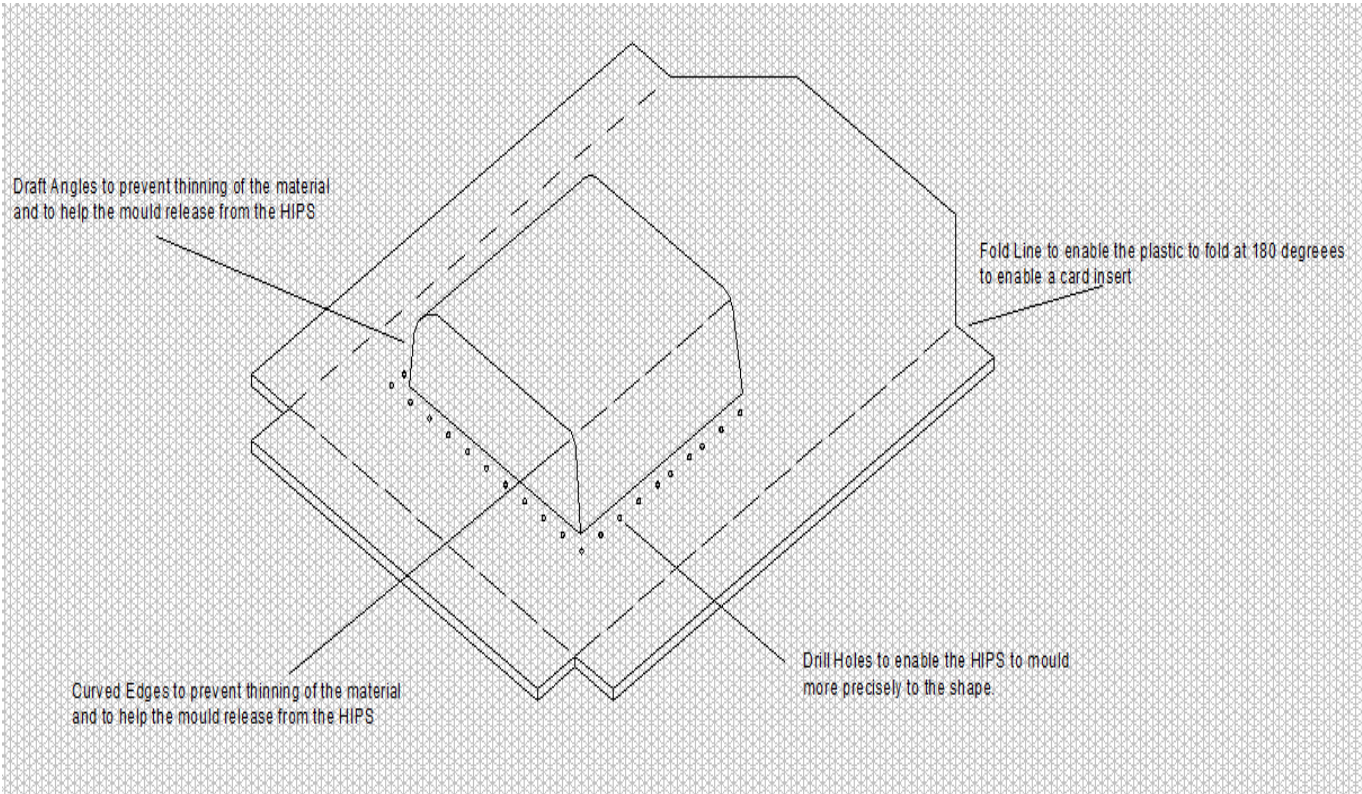
Q	Science	Maths	<p style="text-align: center;">Ferrous and non-ferrous metals</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total															
(d)			<p>A prototype toolbox is tested and evaluated during the process of designing and making.</p> <p>Evaluate the need for testing and evaluating. [6]</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="398 497 1771 1053"> <thead> <tr> <th colspan="3" data-bbox="398 497 1771 544">AO3 2b 6 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="398 544 560 687">BAND 3</td> <td data-bbox="560 544 1666 687">A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating prototypes during the process of designing and making. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td> <td data-bbox="1666 544 1771 687" style="text-align: center;">5-6</td> </tr> <tr> <td data-bbox="398 687 560 863">BAND 2</td> <td data-bbox="560 687 1666 863">Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating prototypes during the process of designing and making. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.</td> <td data-bbox="1666 687 1771 863" style="text-align: center;">3-4</td> </tr> <tr> <td data-bbox="398 863 560 1007">BAND 1</td> <td data-bbox="560 863 1666 1007">Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating prototypes during the process of designing and making. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td> <td data-bbox="1666 863 1771 1007" style="text-align: center;">1-2</td> </tr> <tr> <td colspan="3" data-bbox="398 1007 1771 1053">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p>Indicative content</p> <p>This content is not prescriptive, and candidates are not expected to refer to all the material identified below.</p> <p><i>The usefulness of testing and evaluating prototypes during the process of designing and making.</i></p> <p>Ensures the toolbox:</p> <ul style="list-style-type: none"> • Meets the design specification criteria written by the designer • Meets the demands of the manufacturing specification • Is made with quality throughout 	AO3 2b 6 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating prototypes during the process of designing and making. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating prototypes during the process of designing and making. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating prototypes during the process of designing and making. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
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Q	Science	Maths	<p style="text-align: center;">Ferrous and non-ferrous metals</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
			<ul style="list-style-type: none"> • Fits the target market as expected • Withstands the demands of daily 'wear and tear', for example the panels can withstand use • Meets the demands of the target market at that time • Can hold the weight of tools stored within it • Is durable and hard wearing due to construction and the finish applied to it • Meets the demands of the target market at that time • Dimensions and construction methods are suitable • Allows for changes to be made to the product prior to manufacture. <p><i>Credit any other appropriate response.</i></p>		
				Total	25

Question 6: Thermosetting and thermoforming plastics

Q	Science	Maths	Thermosetting and thermoforming plastics Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			<p>The picture below is of a Rubik's Edge puzzle.</p> <p>State the reason why Polythene is used to manufacture the Rubik's Edge puzzle. [1]</p> <p>Award one mark for a correct reason related to the manufacture. Examples: Cheap in cost (1) Easily moulded (1) Durable (1)</p> <p><i>Credit and other appropriate response.</i></p>	AO4 1a [1]	1
(ii)			<p>The image below shows the nylon flexible ball joints used to connect the Rubik's Edge puzzle.</p> <p>Identify a property of nylon that makes it suitable for a flexible ball joint. [1]</p> <p>Award one mark for a correct reason related to the properties of nylon which make it suitable for the flexible ball joint: Examples: Durable (1) Lightweight (1) Hardwearing (1) Self-Lubricating (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1]	1

Q	Science	Maths	Thermosetting and thermoforming plastics	AO	Total
			Question or outline of question / Marking scheme		
(iii)			<p>Explain why the Rubik's Edge puzzle was designed with flexible ball joints. [2]</p> <p>Up to 2 marks can be awarded for a clear explanation as to why flexible ball joints are used in the children's toy puzzle. One mark can be awarded for each correct reason provided up to a total of 2 marks.</p> <p>Responses could be based upon: A ball joint can provide 360° movement allowing the toy to be rotated in any direction (2) A ball joint moves smoothly (1) allowing the toy to be moved with ease (1) A ball joint allows free movement in two directions at the same time (1) Allowing parts of the toy to rotate (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	2
(iv)			<p>The image below shows an industrial piece of equipment used to manufacture the main parts of the Rubik's Edge puzzle.</p> <p>State the name of this piece of equipment. [1]</p> <p><i>Only acceptable answer for this piece of equipment:</i> Injection Moulding. (1)</p>	AO4 2c [1]	1
(v)			<p>A vacuum forming technique is used to manufacture blister packaging for the Rubik's Edge puzzle.</p> <p>In the space below, use words and sketches to design a simple mould for the blister packaging. [4]</p> <p>Award up to 4 marks for answers that show an understanding of blister packaging and the requirements of the mould for vacuum forming. Both notes and sketches should form part of the answer to gain 4 marks.</p> <p>Considerations:</p> <ol style="list-style-type: none"> 1. Draft angles to stop the HIPS from thinning and to enable the mould to be released 2. Curved edges to stop the HIPS from thinning and to enable the mould to be released 3. Drill holes to enable the HIPS to be sucked around the shape in more detail 4. Fold lines to indicate where the HIPS would need to be bent around to enable a card insert to be put in the packaging. 	AO4 2c [4]	4

Q	Science	Maths	Thermosetting and thermoforming plastics Question or outline of question / Marking scheme	AO	Total
			<p>For example:</p>  <p><i>Credit any other appropriate response.</i></p>		

Q	Science	Maths	Thermosetting and thermoforming plastics Question or outline of question / Marking scheme	AO	Total
(b) (i)		2	<p>Measurements of a display stand for the Rubik's Edge puzzle are shown below.</p> <p>Calculate the minimum length of material needed for Side A of the display stand. Select your final correct answer by circling one of the measurements provided below. Show all workings. [2]</p> <p>120mm <u>160mm</u> 140mm 200mm</p> <p>One mark awarded for the correct answer selected: 160mm (1) One mark to be awarded for correct calculation: $50\text{mm} + 50\text{mm} + (3 \times 20\text{mm})$ (1)</p>	AO4 1b [3] AO4 1c [2]	5
(ii)		3	<p>The Rubik's Edge puzzle uses a set of stickers as shown in the image below.</p> <p>Calculate how many sticker sets can be printed and cut from a length of vinyl that measures 200cm x 90cm. Show all workings. [3]</p> <p><i>Calculation:</i> <i>Size of Sticker sheet</i> <i>Side (20 x 3 - row stickers) + (4 x 2mm Gaps) = 68mm (1)</i></p> <p><i>Sticker Sheet size = 68mm x 68mm or 6.8cm x 6.8cm</i></p> <p><i>200cm / 6.8cm = 29.4 = 29 will fit</i> <i>90cm / 6.8cm = 13.2 = 13 will fit (1)</i></p> <p><i>29 x 13 = 377</i></p> <p><i>377 sheets will fit onto the vinyl (1)</i></p> <p><i>Credit any other appropriate approach to this calculation.</i></p>		

Q	Science	Maths	Thermosetting and thermoforming plastics Question or outline of question / Marking scheme	AO	Total															
(c)			<p>The Rubik's Edge puzzle is manufactured in an economically developing country. Analyse how a designer can ensure the Rubik's Edge puzzle is produced in an ethical and environmentally friendly way. [5]</p> <p>To achieve Band 3 candidates must cover both ethical and environmental considerations.</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="398 533 1796 1088"> <thead> <tr> <th colspan="3" data-bbox="398 533 1796 577">AO3 2a 5 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="398 577 560 721">BAND 3</td> <td data-bbox="560 577 1666 721">A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the Rubik's Edge puzzle is produced in an ethical and environmentally friendly way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1666 577 1796 721">4-5</td> </tr> <tr> <td data-bbox="398 721 560 900">BAND 2</td> <td data-bbox="560 721 1666 900">Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the Rubik's Edge puzzle is produced in an ethical and environmentally friendly way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1666 721 1796 900">2-3</td> </tr> <tr> <td data-bbox="398 900 560 1043">BAND 1</td> <td data-bbox="560 900 1666 1043">Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the Rubik's Edge puzzle is produced in an ethical and environmentally friendly way. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td data-bbox="1666 900 1796 1043">1</td> </tr> <tr> <td colspan="3" data-bbox="398 1043 1796 1088">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p>Indicative content This content is not prescriptive, and candidates are not expected to refer to all the points identified below.</p> <p><i>Environmental Considerations:</i></p> <ul data-bbox="398 1264 1666 1407" style="list-style-type: none"> • Using thermoforming polymers that are recyclable • Consider using biodegradable polymers • Ensuring waste products during manufacturing are disposed of correctly and safely • Use manufacturing plants that are powered by renewable energy sources such as solar power 	AO3 2a 5 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the Rubik's Edge puzzle is produced in an ethical and environmentally friendly way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the Rubik's Edge puzzle is produced in an ethical and environmentally friendly way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the Rubik's Edge puzzle is produced in an ethical and environmentally friendly way. There will be limited evidence of relevant examples or a logical chain of reasoning.	1	Award 0 marks for incorrect or irrelevant answers			AO3 2a [5]	5
AO3 2a 5 marks																				
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Q	Science	Maths	Thermosetting and thermoforming plastics Question or outline of question / Marking scheme	AO	Total
			<ul style="list-style-type: none"> • Ensuring a closed loop system is used in the manufacturing process to minimise wasting materials • Select local manufacturing plants reducing transportation costs and the pollution that results • Ensure raw materials sourced and processed in the same country that is to manufacture them (reducing pollution from excess transportation) • Consider the fuel used to transport raw materials and the product to the retailer • Reduce packaging and/or ensure packaging is recyclable • Ensure the product is manufactured with quality so it functions well and will last • Undertake a Life-Cycle analysis when designing the product • The product is designed with a circular economy approach. <p><i>Ethical Considerations:</i></p> <ul style="list-style-type: none"> • Cultural awareness and local practices are not prohibited based on manufacturing demands • Practices to safeguard the health and well-being of employees are implemented • Pay is fair and employees work acceptable hours, with breaks and in well ventilated, healthy environments • Worker have contracts ensuring regular income • No child labour/exploitation of workers • Ethically sourced raw materials <p>However:</p> <ul style="list-style-type: none"> • Children’s toys can quickly become unfashionable/not used by the child anymore [fad] and are discarded no matter how much was paid for the item • Children’s toys are brought quite commonly by parents who consider the function of the toy more than perhaps ethical and environmental factors/considerations. <p><i>Credit any other appropriate response.</i></p>		

Q	Science	Maths	Thermosetting and thermoforming plastics Question or outline of question / Marking scheme	AO	Total															
(d)			<p>A prototype of The Rubik’s Edge puzzle is tested and evaluated during the process of designing and making. Evaluate the need for testing and evaluating. [6]</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="398 466 1796 933"> <thead> <tr> <th colspan="3" data-bbox="398 466 1796 507">AO3 2b 6 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="398 507 560 646">BAND 3</td> <td data-bbox="560 507 1668 646">A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td> <td data-bbox="1668 507 1796 646">5-6</td> </tr> <tr> <td data-bbox="398 646 560 785">BAND 2</td> <td data-bbox="560 646 1668 785">Answer has some coherence, demonstrating partial knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.</td> <td data-bbox="1668 646 1796 785">3-4</td> </tr> <tr> <td data-bbox="398 785 560 893">BAND 1</td> <td data-bbox="560 785 1668 893">Answer demonstrates only basic knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td> <td data-bbox="1668 785 1796 893">1-2</td> </tr> <tr> <td colspan="3" data-bbox="398 893 1796 933">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p>Indicative content</p> <p>This content is not prescriptive, and candidates are not expected to refer to all the material identified below.</p> <p><i>The usefulness of testing and evaluating:</i> Ensures the children’s toy puzzle:</p> <ul data-bbox="398 1173 1243 1385" style="list-style-type: none"> • Meets the design specification criteria written by the designer • Meets the demands of the manufacturing specification • Is made with quality throughout • Fits the target market as expected • Withstands the demands of daily ‘wear and tear’ • Meets the demands of the target market. 	AO3 2b 6 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, to assess the need for testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
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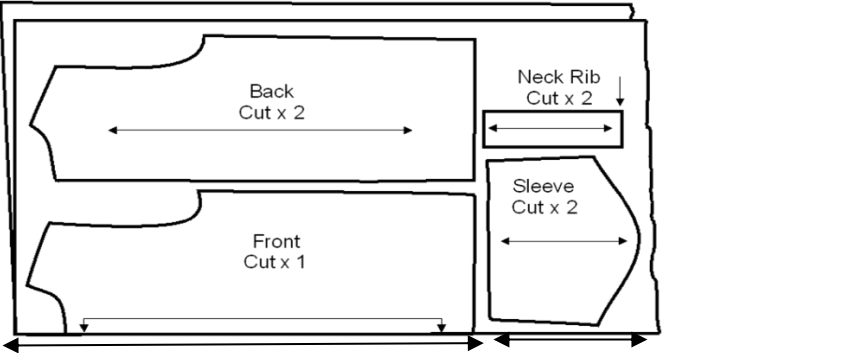
Q	Science	Maths	Thermosetting and thermoforming plastics Question or outline of question / Marking scheme	AO	Total
			<p><i>However:</i></p> <ul style="list-style-type: none"> • Testing and evaluating may add to the retail cost of the product as it is involving additional processes and requires skilled labour/training involvement • Without testing and evaluating, the product may be returned by the consumer as not fit for purpose or as advertised. This has financial consequences for both the retailer and the manufacturer • Testing is not always undertaken at the manufacturing plant. The product may need to be transported to another company for testing, prolonging lead time. <p><i>Credit any other appropriate response.</i></p>		
				Total	25

Question 6: Fibres and Textiles

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			<p>The picture below is of a t-shirt dyed using a resist method.</p> <p>State the resist method used to create the dyed pattern effect on the t-shirt. [1]</p> <p><i>Only acceptable answer for resist method: tie-dye</i></p>	AO4 1a [1]	1
(ii)			<p>Identify what has been used to resist the dye's absorption. [1]</p> <p>When tie dying fabric to resist the dye's absorption elastic bands or string is commonly used.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1]	1
(iii)			<p>The t-shirt is sewn using Flat-fell seams. Explain why Flat-fell seams are used in the construction of the t-shirt. [2]</p> <p>Up to 2 marks can be awarded for a clear explanation as to why flat-fell seams are used in the t-shirt's construction. One mark can be awarded for each correct reason provided up to a total of 2 marks.</p> <p>Responses could be based upon: A flat fell seam is one where the seam allowances are encased within the seam leaving no raw edges (2) A flat fell seam is the most durable of seam types (1) this will ensure the t-shirt can withstand much wear/washing (1) A flat fell seam involves two rows of stitching to increase the durability of the seam (1) and can be sewn in a contrasting thread colour to enhance the aesthetic/appearance (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	2

Q	Science	Maths	Fibres and textiles	AO	Total
			Question or outline of question / Marking scheme		
(iv)			<p>The image below shows a piece of textile equipment used to cut the fabric of the t-shirt.</p> <p>State the name of the equipment. [1]</p> <p><i>Only acceptable answers for this piece of equipment:</i> Round Blade. Rotary Cutter will be accepted.</p>	AO4 2c [1]	1
(v)			<p>When the t-shirt is unsuitable for wear, it will be reused. In the space below, use words and sketches to show how the t-shirt can be cut and sewn to create a simple shopping bag. [4]</p> <p>Award up to 4 marks for answers that show reusing the t-shirt to form a simple shopping bag. Both notes and sketches should be shown to gain 4 marks.</p> <p>For example: sleeves cut and reused for a fastening flap or for pockets; using the front and back of the t-shirt for the main body of the bag.</p> <p><i>Design ideas may include:</i></p> <ol style="list-style-type: none"> 1. Reusing sleeves to form pockets or handles 2. Forming and sewing the bottom of the t-shirt into the base of the bag 3. The hem of the t-shirt could be gathered to form the base of the bag 4. The t-shirt can be recut and sewn to form a tote bag shape 5. The t-shirt can be turned upside down, recut, and turned into a drawstring shopping bag 6. The t-shirt could be cut along the Reglan sleeve line to form handles 7. Shopping bag could be folded and stuffed into an internal pocket created from the sleeves. 	AO4 2c [4]	4

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
			<p>For example:</p> <p>2 marks</p> <p>4 marks</p> <p><i>Credit any other appropriate response.</i></p>		

Q	Science	Maths	<p style="text-align: center;">Fibres and textiles</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total
(b) (i)		2	<p>Measurements for the t-shirt are shown below along with the lay plan of the templates used to make the t-shirt.</p> <p>Calculate the minimum length of material needed to manufacture one t-shirt. Select your final answer by circling one of the measurements provided below. Show all workings. [2]</p> <p style="text-align: center;">54cm 58cm 70cm 74cm</p> <p>One mark awarded for the correct answer selected: 74cm (1) One mark to be awarded for correct calculation: 58cm + 16cm (1)</p> <p>Note: The neck rib would ordinarily be a different material from that of the t-shirt and is therefore not included in the minimum length of material calculation. However, if a candidate interprets the neck rib as part of the calculation:</p> <p>Award one mark if the calculation shown is 58cm + 18cm (1), which is 76cm. Accept 76cm if a candidate offers this in place of the options provided.</p> <div style="text-align: center;">  <p style="text-align: center;">58cm + 16cm = 74cm</p> </div>	AO4 1b [3] AO4 1c [2]	5

Q	Science	Maths	<p style="text-align: center;">Fibres and textiles</p> <p style="text-align: center;">Question or outline of question / Marking scheme</p>	AO	Total															
(ii)		3	<p>The manufacturer decides to cut the neck rib from a separate piece of fabric. Calculate how many pattern pieces can be cut from a length of fabric that measures 200cm x 90cm. Show all workings. [3]</p> <p>Calculation is determined by the direction of the fabric being cut – vertical or horizontal.</p> <p><i>Calculation:</i> Neck rib = 36cm x 5cm</p> <p>200/36cm = 5.6 = 5 neck ribs (1) OR 200/5cm = 40 neck ribs (1) 90/5cm = 18 neck ribs (1) 90/36cm = 2.8 = 2 neck ribs (1) 5 x 18 = 90 neck ribs total (1) 40 x 2 = 80 neck ribs total (1)</p> <p><i>Credit any other appropriate approach to this calculation.</i></p>																	
©			<p>The t-shirt is a high fashion product manufactured in an economically developing country. Analyse how a designer can ensure the t-shirt is produced in an ethical and environmentally friendly way. [5]</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="389 887 1787 1385"> <thead> <tr> <th colspan="3" data-bbox="389 887 1787 927" style="text-align: center;">AO3 2a 5 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="389 927 551 1066" style="text-align: center;">BAND 3</td> <td data-bbox="551 927 1655 1066">A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the t-shirt is produced in an ethical and environmentally friendly way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1655 927 1787 1066" style="text-align: center;">4-5</td> </tr> <tr> <td data-bbox="389 1066 551 1204" style="text-align: center;">BAND 2</td> <td data-bbox="551 1066 1655 1204">Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the t-shirt is produced in an ethical and environmentally friendly way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1655 1066 1787 1204" style="text-align: center;">2-3</td> </tr> <tr> <td data-bbox="389 1204 551 1343" style="text-align: center;">BAND 1</td> <td data-bbox="551 1204 1655 1343">Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the t-shirt is produced in an ethical and environmentally friendly way. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td data-bbox="1655 1204 1787 1343" style="text-align: center;">1</td> </tr> <tr> <td colspan="3" data-bbox="389 1343 1787 1385">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table>	AO3 2a 5 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse how a designer can ensure the t-shirt is produced in an ethical and environmentally friendly way. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse how a designer can ensure the t-shirt is produced in an ethical and environmentally friendly way. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse how a designer can ensure the t-shirt is produced in an ethical and environmentally friendly way. There will be limited evidence of relevant examples or a logical chain of reasoning.	1	Award 0 marks for incorrect or irrelevant answers			AO3 2a [5]	5
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Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
			<p>Indicative content</p> <p>This content is not prescriptive, and candidates are not expected to refer to all the points identified below.</p> <p><i>Environmental Considerations:</i></p> <ul style="list-style-type: none"> • Using fabric that is recyclable or easily biodegradable, e.g., cotton (with no elastane) • Using fabric that has been recycled previously • Ensuring the cotton is organic and/or grown with no use of chemical pesticides and fertilisers • Using dyes from natural origins and/or those that are non-toxic • Reducing manufacturing processing, for example, remove bleaching and/or the mercerisation of cotton that uses caustic chemicals • Ensuring waste products are disposed of correctly and safely • Use manufacturing plants that are powered by renewable energy sources such as solar power • Ensuring lay planning is used to minimise wasting materials on cutting (and discarded) • Select local manufacturing plants reducing transportation costs and the pollution that results • Ensure raw materials are grown and processed in the same country that is to manufacture them (reducing pollution from excess transportation) • Consider the fuel used to transport raw materials and the t-shirt to the retailer • Reduce packaging and/or ensure packaging is recyclable • Is the t-shirt necessary? Has the target market's needs and wants been considered so the t-shirt will sell and not be discarded • Ensure t-shirt is manufactured with quality so it functions well and will last • Undertake a Life-Cycle analysis when designing the product • T-shirt is designed with a circular economy approach. <p><i>Ethical Considerations:</i></p> <ul style="list-style-type: none"> • Cultural awareness and local practices are not prohibited based on manufacturing demands • Practices to safeguard the health and well-being of employees are implemented – from farmers to machinists • Pay is fair and employees work acceptable hours, with breaks and in well ventilated, healthy environments • Worker have contracts ensuring regular income • No child labour/exploitation of workers • Fairtrade – no producer is disadvantaged • Ethically sourced raw materials. 		

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total															
			<p>However:</p> <ul style="list-style-type: none"> • Many of the resources e.g., organic cotton, natural dying, paying a fair wage to farmers, will increase the selling price of the t-shirt • High fashion garments and those that are bold in appearance become unfashionable quickly and are discarded no matter how much was paid for the item • High fashion garments are bought by those who have little disposable income – fashion becomes more important to them than perhaps ethical and environmental factors/considerations • There will always be exploitation of a workforce if consumers don't insist on buying products, like t-shirts, with Fairtrade identification, and with the knowledge the environment has not been impacted upon negatively. <p><i>Credit any other appropriate response.</i></p>																	
(d)			<p>The prototype of the t-shirt is tested and evaluated during the process of designing and making. Evaluate the need for testing and evaluating. [6]</p> <p>Band descriptors and mark allocations</p> <table border="1" data-bbox="389 879 1787 1398"> <thead> <tr> <th colspan="3" data-bbox="389 879 1787 922">AO3 2b 6 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="389 922 551 1066">BAND 3</td> <td data-bbox="551 922 1653 1066">A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td> <td data-bbox="1653 922 1787 1066">5-6</td> </tr> <tr> <td data-bbox="389 1066 551 1209">BAND 2</td> <td data-bbox="551 1066 1653 1209">Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.</td> <td data-bbox="1653 1066 1787 1209">3-4</td> </tr> <tr> <td data-bbox="389 1209 551 1353">BAND 1</td> <td data-bbox="551 1209 1653 1353">Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td> <td data-bbox="1653 1209 1787 1353">1-2</td> </tr> <tr> <td colspan="3" data-bbox="389 1353 1787 1398">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table>	AO3 2b 6 marks			BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, to assess the usefulness of testing and evaluating as processes in the design cycle. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
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Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
			<p>Indicative content</p> <p>This content is not prescriptive and candidates are not expected to refer to all the material identified below.</p> <p><i>The usefulness of testing and evaluating:</i> Ensures the t-shirt:</p> <ul style="list-style-type: none"> • Meets the design specification criteria written by the designer • Meets the demands of the manufacturing specification • Is made with quality throughout • Fits the target market as expected • Washes well without damage and in accordance with the care label instructions • Is colourfast • Withstands the demands of daily ‘wear and tear’, for example, the stitching will not unravel once worn; • Is made from a knitted fabric that doesn’t distort or stretch out of shape once worn • Meets the demands of the target market and the trends/fashions at that time. <p><i>However:</i></p> <ul style="list-style-type: none"> • Testing and evaluating can extend the length of time the product takes to arrive to the customer. This could mean, high fashion products, like a tie-dye t-shirt, never reach their sale peak – the fashion trend disappears as soon as it arrives • Testing and evaluating may add to the retail cost of the product as it is involving additional processes and requires skilled labour/training involvement • Without testing and evaluating, the product may be returned by the consumer as not fit for purpose or as advertised. This has financial consequences for both the retailer and the manufacturer • Testing is not always undertaken at the manufacturing plant. The t-shirt may need to be transported to another company for testing, prolonging lead time. <p><i>Credit any other appropriate response.</i></p>		
				Total	25