



GCSE MARKING SCHEME

SUMMER 2024

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

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

EDUQAS GCSE DESIGN & TECHNOLOGY – COMPONENT 1

SUMMER 2024 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

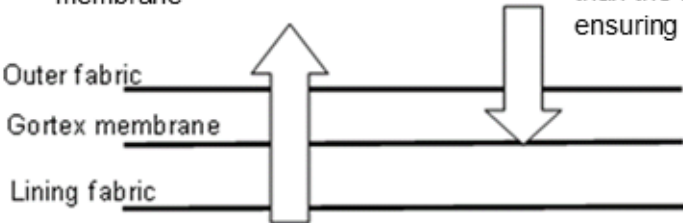
This question is about Design and Technology and our world.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
1. (a) (i)		1	The pie chart below shows the United Kingdom's (UK's) energy consumption by fuel type. State the least consumed fuel type. [1] Award one mark for correct response: Coal <i>Only acceptable response.</i>	AO4 1b [1]	1
(ii)		3	Calculate the total percentage of non-renewable energy sources consumed. <i>Show all workings.</i> [3] Award one mark for each correct step in the calculation. Three marks can be awarded for a correct calculation process with the correct final answer. Coal + Oil + Nuclear Energy + Natural Gas (1) 3% + 40% + 7% + 36% or 100% - 14% (1) Total = 86% (1) <i>Credit any appropriate approach to calculating the total percentage.</i>	AO4 1c [3]	3

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(iii)			Give one reason why the UK needs to decrease its use of oil as an energy source. [1] Answers must be related to oil as a source of energy. For example: Oil is extracted from the earth and is therefore a fossil fuel (1) Fossil fuels will eventually run out and cannot be replaced (1) Burning oil produces waste products which are pollutants (1) Burning oil contributes to global warming (1) Inhaling pollutants from burning oil can cause respiratory diseases (1) <i>Credit any other appropriate response.</i>	AO4 1b [1]	1
(b) (i)	✓		The products shown below use photovoltaic (PV) cells to function. [2] Describe how photovoltaic cells work. The photovoltaic effect = converting sunlight (1) into electricity (1) Other similar responses: • Light shines on the cell to create an electric field causing electricity to flow (2) • Photovoltaic cells are semi-conducting materials producing electricity from sunlight (2) • Photovoltaic cells generate electricity when exposed to photons, particles of light (2) • Photovoltaic cells use solar energy that power or charge appliances (2) <i>Credit any other appropriate response.</i>	AO4 1a [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)	✓		Explain why products with small photovoltaic cells have not been popular with consumers. [3] Answers must relate to the photovoltaic cell products. 1 mark for a suitable reason, up to a maximum of two marks for two reasons. 1 additional mark to be awarded for a clear explanation. For example: Photovoltaic cells products have low energy efficiency (1) compared to non-renewable energy sources (1) as sunlight is unpredictable (1) Other examples: • Electricity store is small in area (1) • You can't always tell how much energy has been stored (1) • Needs sunlight to function (1) • Energy from sun is unpredictable (1) • Power reduced during cloudy or overcast weather (1) • Can affect the aesthetic of the product (1) • Can be fragile and damaged easily (1) • Cumbersome to carry (charger) (1) <i>Credit any other appropriate response.</i>	AO4 1b [1] AO4 1c [2]	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
2. (a) (i)	✓		The products below are made with a breathable and waterproof membrane material. State one reason why these products need to be breathable. [1] Award 1 mark for correct answer. Examples: • Prevent the user from feeling 'damp' or 'sweaty' during activities; • Keeps user comfortable / consistent temperature; • Prevents the user experiencing heavier clothing / boots (breathable membranes are light in weight) <i>Credit any other appropriate response that is known as a breathable and waterproof membrane.</i>	AO4 1a [1]	1
(ii)	✓		In the space below draw and label a diagram that shows how this breathable and waterproof membrane material functions. [4] Perspiration molecules are smaller than the holes in the membrane Rain/water molecules are larger than the holes in the membrane ensuring the wearer stays dry.  Note: laminated membranes do not always have a lining. Do not penalise if a lining material is not referenced in answer. Up to four marks to be awarded:	AO4 1b [2] AO4 2c [2]	4

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total									
			• Understanding of the breathable function (1) • Understanding of the waterproof function (1) • Simple but accurate illustration/labelling up to two marks (2) <i>Credit any other appropriate response.</i>											
(b) (i)	✓		The picture below shows a geotextiles material used for outdoor building construction and maintenance. Put a tick (✓) in the table below to indicate whether the following statements are true or false. [2] <table><tr><th>Statement</th><th>True</th><th>False</th></tr><tr><td>Geotextiles can be woven materials.</td><td>✓</td><td></td></tr><tr><td>Geotextiles can be made from both synthetic and natural fabrics.</td><td>✓</td><td></td></tr></table> <i>Only acceptable responses.</i>	Statement	True	False	Geotextiles can be woven materials.	✓		Geotextiles can be made from both synthetic and natural fabrics.	✓		AO4 1c [2]	2
Statement	True	False												
Geotextiles can be woven materials.	✓													
Geotextiles can be made from both synthetic and natural fabrics.	✓													

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)	✓		Discuss how Geotextiles are benefiting the outdoor and construction industry. [3] Award a maximum of two marks for two benefits. At least one benefit needs to be discussed for three marks to be awarded. Examples: Geotextiles are permeable which makes them suitable for soil protection (1). In addition, they help drain rainwater evenly (1) and restrict sunlight preventing weed growth (1). This reduces maintenance times spent on roadside verges (1). Using Geotextiles makes poor soil more manageable, enabling construction in places that would otherwise be unsuitable (1). Some geotextiles are made from recycled materials (1) Geotextiles can be divided into three categories for use: Separation, Reinforcement and Filtration & Drainage. Examples of use: • Unpaved and paved roads • Airport runways • Landfills • Car parks • Recreational/green areas • Retaining wall structures/control of erosion to increase the stability of earth mass • Separation of dissimilar materials e.g. preventing fine and coarse aggregates from merging • Sand drainage • Roadside pipelines • Insulation (e.g. for pipes) • Sufficiently durable for 100 years • Can be made waterproof <i>Credit any other appropriate response.</i>	AO3 2a [3]	3
				Total	10

This question is about smart, composite and technical materials.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total					
3. (a) (i)			The image below is of a modern record player State the type of motion the record will take when being played. [1] Answer: Rotary motion. <i>Only acceptable answer.</i>	AO4 1b [1]	1					
(ii)	✓		State the meaning of rpm. [1] Answer: Revolutions per minute (accept Rotations). <i>Only acceptable answer.</i>	AO4 1b [1]	1					
(iii)	✓		Put a tick (✓) in the grid below to indicate which record speed would take longer to play. [1] <table border="1"><tr><td rowspan="2">Record</td><td>33rpm</td><td>45rpm</td></tr><tr><td>✓</td><td></td></tr></table> <i>Only acceptable answer.</i>	Record	33rpm	45rpm	✓		AO4 1b [1]	1
Record	33rpm	45rpm								
	✓									
(iv)	✓	2	Calculate the number of times a 45rpm record will rotate in 4 minutes. <i>Show all workings.</i> [2] Award one mark for each correct step in the calculation: 45rpm x 4 (1) = 180 rotations (1) <i>Credit any appropriate approach to correct calculation.</i>	AO4 1c [2]	2					

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total																		
(b) (i)	✓	2	The image below is of the record player's pulley and belt drive. Calculate the velocity ratio of the driven pulley. <i>Show all workings.</i> [2] Award one mark for each correct step in the calculation: Velocity ratio = $\frac{\text{diameter of the driven pulley}}{\text{diameter of the driver pulley}}$ 180mm/20mm (1) = 9 or 9:1 (1) <i>Credit any appropriate approach to correct calculation.</i>	AO4 1c [2]	2																		
(ii)	✓		Describe the differences between a simple gear train and a pulley and belt drive. [4] Award up to 2 marks for two differences if simply stated. An additional two marks to be awarded if described and/or compared. <table><tr><th>Simple Gear Train</th><th>Pulley and Belt Drive</th></tr><tr><td>Driver and driven shafts rotate in opposite directions.</td><td>Driver and driven shafts can rotate in the same or opposite directions.</td></tr><tr><td>The distance between the input shaft and output shaft is limited.</td><td>The input shaft and output shaft can be separated by a 'greater' distance (than simple gear train).</td></tr><tr><td>Is an 'engagement' drive.</td><td>Is a 'friction' drive.</td></tr><tr><td>Cannot tolerate misalignment.</td><td>Can tolerate a small amount of misalignment.</td></tr><tr><td>Lubrication required.</td><td>Lubrication not (or seldom) required.</td></tr><tr><td>More expensive to maintain.</td><td>Limited (if any) maintenance required = cheaper.</td></tr><tr><td>Not affected by small changes in atmospheric temperature.</td><td>The length of the belt can increase if the temperature increases, and belt slip can occur.</td></tr><tr><td>Driver and driven shafts are connected by rigid links.</td><td>Driver and driven shafts are connected by a flexible element (belt).</td></tr></table>	Simple Gear Train	Pulley and Belt Drive	Driver and driven shafts rotate in opposite directions.	Driver and driven shafts can rotate in the same or opposite directions.	The distance between the input shaft and output shaft is limited.	The input shaft and output shaft can be separated by a 'greater' distance (than simple gear train).	Is an 'engagement' drive.	Is a 'friction' drive.	Cannot tolerate misalignment.	Can tolerate a small amount of misalignment.	Lubrication required.	Lubrication not (or seldom) required.	More expensive to maintain.	Limited (if any) maintenance required = cheaper.	Not affected by small changes in atmospheric temperature.	The length of the belt can increase if the temperature increases, and belt slip can occur.	Driver and driven shafts are connected by rigid links.	Driver and driven shafts are connected by a flexible element (belt).	AO4 1b [4]	4
Simple Gear Train	Pulley and Belt Drive																						
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Q	Science	Maths	Question or outline of question / Marking scheme		AO	Total								
			<table><tr><td>A positive drive so the velocity ratio remains constant.</td><td>A non-positive drive as slip and creep can occur.</td></tr><tr><td>Cannot isolate driver shaft from vibrations on the driven shaft.</td><td>The flexibility of belt can absorb vibrations and therefore protects the driver shaft.</td></tr><tr><td>The high-speed reduction can be achieved easily.</td><td>Cannot provide steep velocity reduction.</td></tr><tr><td>Uses circles with teeth that mesh together</td><td>A grooved wheel linked by a belt</td></tr></table>	A positive drive so the velocity ratio remains constant.	A non-positive drive as slip and creep can occur.	Cannot isolate driver shaft from vibrations on the driven shaft.	The flexibility of belt can absorb vibrations and therefore protects the driver shaft.	The high-speed reduction can be achieved easily.	Cannot provide steep velocity reduction.	Uses circles with teeth that mesh together	A grooved wheel linked by a belt			
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The high-speed reduction can be achieved easily.	Cannot provide steep velocity reduction.													
Uses circles with teeth that mesh together	A grooved wheel linked by a belt													
			<i>Credit any other appropriate response. (Do not penalise the lack of technical terminology) Accept a balanced response 2-2, 3-1 for full marks.</i>											
(c)			Technology Push and Market Pull help product development. Discuss why products that download or stream music have increased in popularity over recent years. [4] One mark for each reason identified up to a maximum of three. Two issues discussed well should be awarded full marks. Answers must relate to downloading/streaming music and/or Technology Push and Market Pull. Defining Technology Push and Market pull can be credited when used to refer to downloading or streaming music. <u>Technology Push</u>: a development in materials, components or manufacturing methods that lead to the development of new products/services. <u>Market Pull</u>: a new product/service is produced in response to demand from the market.		AO4 2a [2] AO4 2b [1] AO4 1b [1]	4								

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
			<i>Comments could include:</i> Consumers have demanded and/or technology has allowed: • A more cost-effective method of listening to a broader range of music/can be streamed for free • access to a vast selection of music • a superior sound quality of streamed music that is superior to that of CDs • music that is more accessible anywhere on the planet • access to out-of-print recordings • accessibility that doesn't take up space on personal hard drives • an ability to create their own playlists • accessibility to new artists and genres of music • notifications when new music releases become available • artists themselves to have a chance of being discovered if their music can be downloaded • Bluetooth – no wires and portability of small devices • reduced costs as demand for music (and devices) has increased (economies of scale) However: • subscribers don't own a copy of the music they have streamed • those who profit the most from music streaming are big corporate and tech companies • technology allows music streaming services to collect user information • music that has been streamed can't be digitally reproduced • streaming ultimately causes established artists to lose potential earnings • often, "free" music streaming services have hidden subscription fees • subscribers never get to see, or appreciate, the work that has been put into creating an original album cover • consumers have – in recent years – demanded a reintroduction of vinyl records, and album covers have become collector items. <i>Credit any other appropriate response.</i>		
				Total	15

This question is about materials.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
4. (a) (i)			The image below shows a child's puzzle made from a laminated board. Describe how a laminated board is formed. [2] Awarded up to two marks for an accurate description. For example: Laminated boards are formed by gluing (1) veneers (1) together. Award 1 mark if an example of a laminated board is provided as part of the description, e.g., plywood. <i>Credit any other appropriate response</i>	AO4 1a [2]	2
(ii)			Explain, using an example, how the aesthetics of the puzzle can be improved. [2] One mark for an appropriate answer, one mark for explanation. For example: Painting (1) using acrylic paint changes the woods colour to attract the child's attention (1). Painting (1) the wood shapes in different colours would help children learn (1) the names of each colour. The laser cut edges are burnt and need aesthetic improvement (1) changing the laser cutter settings would improve this (1) Replacing the material (1) with colourful acrylic, which would attract the user more/hold attention span for longer (1). Other suitable finish examples: • Varnish (1) • Wood stain (1) • Oils e.g. Danish (1) <i>Accept:</i> the dinosaur shapes could be changed to other animals (1). <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b) (i)	✓		The images below show a cuff bracelet made from aluminium with a decorative finish applied. Identify two properties that make alluminum a suitable metal for the cuff bracelet. 2 x [1] One mark for each property suggested up to a maximum of two marks. For example: • Malleable (1) • Lightweight (1) • Corrosion resistant (1) • Non-toxic (1) • Low density (1) • Durable (1) • High strength to weight ratio (1) <i>Credit any other appropriate response.</i>	AO4 1c [2]	2
(ii)	✓		Unfinished aluminium can be affected by oxidisation. Describe how oxidation affects the appearance of aluminium. [2] The surface of the aluminium will become white (1) and lose it's clean and shiny appearance (1). Unfinished aluminium has a strong affinity for oxygen (1) and the resulting oxide forms a hard whitish-coloured surface (1). Aluminium metal will readily react with water at room temperature to form aluminium hydroxide and hydrogen. However, this reaction doesn't typically occur because a layer of aluminium oxide naturally coats the raw metal, preventing it from coming directly into contact with water. (Accept terms like becomes dull, chalky, powdery grey, gritty / uneven finish, rather than smooth). <i>Credit any other appropriate response.</i>	AO4 1c [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total									
(c) (i)	✓		The picture below shows two drinking cups made from different polymers. Put a tick (✓) in the table below to identify whether each polymer is thermoforming or thermosetting. 2 x [1] <table><tr><th>Polymer Category</th><th>Thermoforming</th><th>Thermosetting</th></tr><tr><td>Polypropylene (PP)</td><td style="text-align: center;">✓</td><td></td></tr><tr><td>Melamine Formaldehyde (MF)</td><td></td><td style="text-align: center;">✓</td></tr></table> Only acceptable answers.	Polymer Category	Thermoforming	Thermosetting	Polypropylene (PP)	✓		Melamine Formaldehyde (MF)		✓	AO4 1a [2]	2
Polymer Category	Thermoforming	Thermosetting												
Polypropylene (PP)	✓													
Melamine Formaldehyde (MF)		✓												
(ii)	✓		Discuss the properties of polypropylene (PP) and melamine formaldehyde (MF) that make them suitable materials for the drinking cups. [6] Answers must relate to the properties of <i>both</i> polypropylene (PP) and melamine formaldehyde (MF). Up to 3 marks for discussing a <i>maximum</i> of 3 <i>different/similar, properties</i>. Appropriate properties in relation to the drinking cups should only be given credit. An additional 3 marks for justifications or supporting comments and/or comments that compare similar properties, up to a total of 6 marks. A maximum of two marks can be awarded if three correct properties are simply listed. Credit should not be given for simply stating these materials are ‘cheap’ or ‘strong’. For example: Polypropylene has excellent thermal properties (1) which means it is suitable for both cold and hot drinks (1). This thermoforming plastic is light in weight (1) and is therefore easy to hold/use by most target markets even when full of liquid (1). In addition, melamine formaldehyde is resistant to staining (1) which is an advantage when using it for coffee and tea which stain other cup materials (1).	AO4 1a [1] AO4 1c [5]	6									

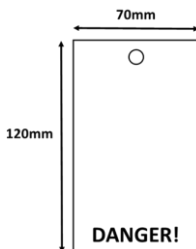
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total		
			Appropriate properties for drinking cups: <table><tr><td>Polypropylene: • Good heat and chemical resistance • Lightweight • Excellent thermal insulator • Good tensile strength and difficult to break • Waterproof • Resistant to bacteria • Recyclable </td><td>Melamine Formaldehyde: • Excellent tensile strength • Excellent heat and flame resistance • Resistant to scratching or staining • Smooth surface/aesthetic • Durable • Cannot be recycled </td></tr></table> Manufacturing Methods: Responses may comment and/or compare manufacturing methods of the drinking cups. Credit should be awarded for discussing the drinking cups can be injection moulded (most common method) and/or compression moulded (melamine formaldehyde). <i>Credit any other appropriate response. If only one material is discussed, award up to 4 marks. To achieve 6 marks, both materials need to be discussed.</i>	Polypropylene: • Good heat and chemical resistance • Lightweight • Excellent thermal insulator • Good tensile strength and difficult to break • Waterproof • Resistant to bacteria • Recyclable	Melamine Formaldehyde: • Excellent tensile strength • Excellent heat and flame resistance • Resistant to scratching or staining • Smooth surface/aesthetic • Durable • Cannot be recycled		
Polypropylene: • Good heat and chemical resistance • Lightweight • Excellent thermal insulator • Good tensile strength and difficult to break • Waterproof • Resistant to bacteria • Recyclable	Melamine Formaldehyde: • Excellent tensile strength • Excellent heat and flame resistance • Resistant to scratching or staining • Smooth surface/aesthetic • Durable • Cannot be recycled						
(d) (i)			The image below shows corrugated cardboard packaging used to store a drinking cup. State the correct ISO size the packaging would be cut from. [1] Answer: A3 <i>Only acceptable response.</i>	AO4 2a [1]	1		

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			State the meaning of the logo pictured below that is printed on the packaging. [1] Accept answers relating to: This material can be Recycled/Recyclable (and possibly made from recycled materials). <i>Only acceptable answer. The word 'recycling' in isolation is not enough of a response to the question to be awarded any marks.</i>	AO4 1b [1]	1
(iii)			Describe why corrugated cardboard is a suitable material for the packaging of the drinking cup. [1] One mark for an appropriate reason why corrugated cardboard has been used for the packaging, and one mark for explanation/justification. A maximum of one mark for simply stating a <i>suitable</i> reason. For example: The fluted structure of corrugated cardboard protects by absorbing knocks and bumps (1), keeping the product from damaging during transportation (1). Corrugated cardboard is light in weight (1), limiting the cost of postage/transportation (1). Corrugated cardboard is made from recycled materials (1), making it more sustainable than other packaging materials (1). Properties not accepted: • Heat resistant • Can be shaped relatively easily <i>Credit any other appropriate response.</i>	AO4 1c [2]	2
				Total	20

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (a) (i)			State a suitable target market for your selected product. [1] One mark for identifying a suitable target market, for example: children, teenagers, adults. Accept answers that are specific to the kit product selected, for example: knitters, people interested in crafts, model makers. Note: none of these kit products are suitable for very young children (for example, below the age of 3) as they can be a choking hazard and/or too complex as fine motor skills need to be well developed. <i>Credit any other appropriate response.</i>	AO4 2b [1]	1
(ii)			Describe two problems the target market selected in 1a(i) above could have when constructing and using the kit product chosen. [4] 2 x one mark for each problem identified up to a maximum of two marks. An additional mark can be awarded for a clear description for each of the problems identified. Ensure answers provided relate to the kit product selected. Possible problems when constructing and using kits: • Parts are easily lost or need replacing; • Replacing parts are hard to find/buy and will cost more money; • Frustration if construction is unsuccessful/too difficult; • Instructions provided may not be clear and the user may 'give up' completion; • Boredom – once kit is made the challenge of the build is over; • Once the kit is made/built it can't be developed or changed (not relevant to metal/plastic kit); • Kit products are not always appropriate for play; • Cost – the cost of the kit product far exceeds the cost of the component parts; • Finish – some components parts are not finished and could cause harm; • Dangerous – sewing needles, for example, could harm users as sharp/swallowing/choking hazard. Give credit for responses that reference sustainability – once build/made kit products may be thrown away. Component parts may not be easy to recycle. <i>Credit any other appropriate response.</i>	AO4 2a [3] AO4 1b [1]	4

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(iii)			The kit product's designer produced a working drawing. Describe the information the designer would include in the working drawing. [4] Up to three marks for each correct piece of information identified. Full marks can be awarded for two correct pieces of information that have been described clearly. Credit with one mark if a definition of a working drawing is included within the response provided. A working drawing is a technical document. It provides details about a design (or product). The details are informative such as a third party could attempt successful manufacture. Information founded on a working drawing: • Dimensions (mm); • Parts and components (Parts List) / including materials; • Drawings of product – 2D, 3D, scale; • 3D CAD models / files/ CAM settings; • Sectional drawings and/or exploded drawings/orthographical drawings; • Drawings of internal features; • Credit reference made to BSI; • Lay plan. <i>Credit any other appropriate response.</i>	AO4 1b [3] AO4 2b [1]	4

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b) (i)			Systems thinking is a creative design strategy. Describe the importance of system thinking when improving products. [2] Up to two marks for a clear description of system thinking when improving products. Award one mark for a response that lacks clarity in understanding but is correct. For example: Systems thinking is a design strategy that considers a design problem as a whole experience for the user rather than just the product itself. It includes the ease of purchase and how the user will feel on opening the product's packaging. In addition, it looks at how easy the product is to use, care for, and maintain and how easy (and appropriately) it can be disposed of. <i>Credit any other appropriate response.</i>	AO3 2b [2]	2
(ii)			Analyse how user testing benefits product development. [4] Up to 4 marks for identifying and discussing the benefits/disadvantages of user testing for product development. A maximum of two marks can be awarded for just identifying the benefits/disadvantages without any discussion. Marks can be awarded for discussing the disadvantages such as the time it takes to complete the user trials and the cost implications that result. Examples could include: User testing helps foresee problems early in product development (1). This can help the end product to be successful in the marketplace (1). Feedback can suggest how a product could be improved (1) which helps the designer make changes promptly and ensures products are suitable for intended target users (1). User trials can suggest modifications to products in the later stages of their lifecycle (1) that can reintroduce them back into the marketplace (incremental development) (1). The disadvantage is that information gathered may be contradictory making decision making for the designer difficult. (1) In addition, the time it takes to gather feedback means there is a delay in production (1) missing out on sales/market capitalisation (1) and increases the retail cost of the product (1). This could then price the product out of the marketplace (1). <i>Credit any other appropriate response.</i>	AO3 2b [4]	4

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(c)		5	The diagram below is of a swing tag that is to be attached to each of the kit products.  The swing tags are laser cut from card sheets that measure 4m x 2m. Calculate the maximum number of swing tags that can be cut from 12 card sheets. <i>Show all workings.</i> [5] One mark to be awarded for each correct process in the calculation, up to a maximum of 3 marks. 5 marks to be awarded for correct answer with all correct workings shown. A maximum of three marks for correct answer with little or no evidence of calculation. Note: there are two possible answers to this calculation. $4\text{m (4,000mm)} / 70\text{mm} = 57.14 = 57 \text{ swing tags (1)}$ $2\text{m (2,000mm)} / 120\text{mm} = 16.6 = 16 \text{ swing tags (1)}$ $57 \times 16 = 912 \text{ swing tags (1)}$ $912 \times 12 \text{ card sheets} = \mathbf{10,944 \text{ swing tags (1)}}$ $4\text{m (4,000mm)} / 120\text{mm} = 33.3 = 33 \text{ swing tags (1)}$ $2\text{m (2,000mm)} / 70\text{mm} = 28.6 = 28 \text{ swing tags (1)}$ $33 \times 28 = 924 \text{ swing tags (1)}$ $924 \times 12 \text{ card sheets} = \mathbf{11,088 \text{ swing tags (1)}}$ An additional mark (to make 5 marks) to be awarded for correct workings and correct answer. <i>Credit any appropriate approach to calculation.</i>	AO4 1a [2] AO4 1c [3]	5
				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)			The picture below shows a steady hand game. The game contains a thyristor circuit. Give the names of pins labelled 1 and 2 on the thyristor symbol below. [2] Pin 1: Gate or control terminal. Pin 2: Cathode negative terminal. <i>Credit any other appropriate response.</i>	AO4 1a [1] AO4 1b [1]	2 x [1]
(ii)			Describe one advantage of using a thyristor in the steady hand game. [2] Up to 2 marks can be awarded for describing one advantage of using a thyristor in a steady hand game. One mark can be awarded for a correct answer without a description or example. Responses could be based upon: 1. When the handle touches the wire shape, the buzzer will sound (1) until the reset push switch is pressed. The thyristor activates the buzzer and 'latches'. (1) 2. The primary function of a thyristor is to control current by acting as a switch (1) The switch will stay 'latched on' once the stimulus the trigger voltage has gone away. (1) 3. The buzzer will sound even if the handle is moved away from the wire (1) to turn it off would need the power source to be disconnected. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Electronic systems, programmable components and mechanical devices	AO	Total
			Question or outline of question / Marking scheme		
(iii)			The image below shows a piece of hand-held equipment used to remove the excess wire from a populated circuit board. State the correct name of the equipment. [1] <i>Only acceptable answers for this piece of equipment:</i> Side cutters or wire cutters.	AO4 2c [1]	1
(iv)			Precise soldering is important when populating the pre-drilled PCB for the steady hand game. In the space below, use words and sketches to show how a resistor would be soldered onto a circuit board precisely and securely. [4] Award up to 4 marks for answers that demonstrate a clear understanding of the stages needed to solder a resistor to a printed circuit board. Award a maximum of 2 marks for clear sketching of processes even if written communication is missing. <i>Answers provided may include:</i> 1. Mount the component - insert the leads of the resistor into the holes of the circuit board (1). 2. Flip PCB and heat the joint - Hold the (hot) soldering iron in place for 3-4 seconds in order to heat the pad and the lead (1). 3. Apply Solder to Joint - continue holding the soldering iron on the copper pad and the lead and touch the solder to the joint. Keep heating until a pyramid/cone shape appears (1). 4. Snip the leads - remove the soldering iron and let the solder cool down and then snip the extra wire from leads. (1) <i>Credit any other appropriate response.</i>	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)		5	The steady hand game circuit board is lifted from its casing using 4 spacers. The material required for each spacer measures 8mm^2. Each spacer needs a profile tool path allowance of 1.5mm. Calculate the length of one spacer with the profile tool path allowance. [1] One mark to be awarded for the correct answer: $8\text{mm} + 3\text{mm} = \mathbf{11\text{mm}}$ Note: The tool path is 1.5mm The diagram shows a square spacer. The inner square is labeled '8mm'. It is surrounded by a border labeled '1.5mm tool path' on the left and right sides. The total width of the outer square is labeled '11mm' at the top. (ii) The spacers are to be cut from a piece of plastic that is 110 mm wide. Calculate the length of plastic needed to manufacture 200 steady hand game spacers. Show all workings. [4] 200 x 4 spacers = 800 spacers (1) $110/11 = \mathbf{10\text{mm}} = \mathbf{10}$ spacers in one width of plastic. (1) $800/10 = \mathbf{80}$ (1) $80 \times 11 = \mathbf{880\text{mm}}$ (1) <i>Credit any other appropriate approach to these calculations.</i>	AO4 1b [3] AO4 1c [2]	5

Q	Science	Maths	Electronic systems, programmable components and mechanical devices	AO	Total															
			Question or outline of question / Marking scheme																	
(c)			In commercial manufacture, PCBs are cut using a CNC machine. Analyse the advantages and disadvantages of cutting PBSs using a CNC machine. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of cutting PCBs using a CNC machine / router. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages and disadvantages of cutting PCBs using a CNC machine / router. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the advantages and disadvantages of cutting PCBs using a CNC machine / router. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Advantages of cutting PCBs using a CNC machine:</i> CNC machines are programmed with a circuit board design that can then be manufactured hundreds or even thousands of times. Tracks on a PCB can be manufactured accurately and will be exactly the same.		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of cutting PCBs using a CNC machine / router. 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 the advantages and disadvantages of cutting PCBs using a CNC machine / router. 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 the advantages and disadvantages of cutting PCBs using a CNC machine / router. 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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	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
			• Modern design software allows the designer to simulate the manufacture of a PCB. There is no need to make a prototype or a model. This saves time and money. • A single CNC machine can be used for milling, drilling, and cutting circuit boards. • CNC machines will easily cut through multiple circuit boards at a time. This saves time and money. • CNC machines can be updated by improving the software used to drive the machines. • Less skilled/trained people can operate CNCs, unlike manual lathes/milling machines which need skilled engineers. • One person can supervise many CNC machines as once they are programmed, they can usually be left to work by themselves. Sometimes only the cutting tools need replacing occasionally. • A CNC helps to reduce waste by optimising material usage. • Fast cutting speeds. <i>Disadvantages of cutting PCBs using a CNC router:</i> • CNC machines / routers are relatively loud because of the vacuum system, extraction, and spindle. • Any misalignment or deviation in drilling or milling tool causes inaccuracies in the fabricated PCBs. The PCB object's position precision is highly dependent on the machine spindle and tool. • The tools used to cut and drill the circuit boards don't last forever and will need to be replaced with new units when they are worn or broken. • Loss of skilled labour within the workforce, the machine does all of the hard work. • Skills loss. Due to the limited training needed a lot of the old skills used to manually create parts are lost. With automated machining so readily available students are no longer taught to manually create parts. <i>Credit any other appropriate response. Answers must include both advantages and disadvantages to access the full 5 marks.</i>		

Q	Science	Maths	Electronic systems, programmable components and mechanical devices	AO	Total															
			Question or outline of question / Marking scheme																	
(d)			Discuss how designers can improve and extend the life of electronic products to lessen their impact on our environment. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of electronic products to lessen the impact on our environment. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to discuss how designers can extend the life of electronic products to lessen the impact on our environment. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to discuss how designers can extend the life of electronic products to lessen the impact on our environment. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below. <i>Examples of how improving and extending the life of electronic products can lessen the impact on our environment:</i> • Eliminate or reduce sensitive substances from electronic products. Lead and lead soldering can be replaced, for instance, by tin/silver/copper alloy when attaching electronic components.		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of electronic products to lessen the impact on our environment. 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 discuss how designers can extend the life of electronic products to lessen the impact on our environment. 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 discuss how designers can extend the life of electronic products to lessen the impact on our environment. 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 discuss how designers can extend the life of electronic products to lessen the impact on our environment. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6																		
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	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
			• Include power management features, such as low-power standby mode, auto power savings, and user-activated power options. • Solar is becoming increasingly viable for self-powered devices; for wearables, energy can be harvested from body motions. • Design, when possible, smaller products that will need fewer materials and resources in manufacturing and which will also generate less waste at the end of their lifecycle. • Replace difficult-to-recycle plastics with lighter and more durable materials, such as aluminium and magnesium, that make the products more valuable to recycle. • Design the product for reusable and long-life batteries instead of single-use batteries. • Consider using fewer screws and screw types to reduce the time required for disassembly. Including more snap-fit parts is a good alternative as well. • Consider adopting a part-update approach. Instead of constantly releasing new versions of the product, offer the option to only change the part that was updated (e.g. the camera on a smartphone). • Consider repair procedures as part of your mechanical design process so that one small failure does not lead to the disposal of the whole product. <i>However:</i> • cost – The end users may not be prepared to pay the cost of sustainable electronic products. • It might be difficult to clearly demonstrate the benefits of sustainable electronics to buyers. They may prefer cheaper options. • There are risks associated with trying new materials and approaches. • Finding alternative ways to make money out of longer-life products could be challenging. • Set-up costs to change manufacturing systems to become more environmentally friendly is expensive; • The general public lacks knowledge; therefore, there's a lack of consumer acceptance. If there's a lack of customer demand, progress and mass-market production will slow down. <i>Credit any other appropriate response.</i>		
				Total	25

Question 6: Papers, Board and Card

Q	Science	Maths	Papers, Board and Card Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The product below is a blank puzzle for children to design their own pictures or patterns by drawing and colouring them in. Papers, boards and card are available in many different types. In the table below give an example of a Paper and a Board. [2] Paper Examples: Bleed proof paper, cartridge paper, grid paper, layout paper, tracing paper, copier paper, sugar paper Card Examples: Corrugated card, duplex board, foil lined board, foam core board, solid white board, virgin fibre board <i>Credit any other appropriate response.</i>	AO4 1a [1] AO4 1b [1]	2 x [1]
(ii)			Papers, boards and card can have surface finishes applied for different purposes. Describe one advantage of applying a surface finish on papers, board and card. [2] Up to 2 marks can be awarded for a described advantage as to why a coating would be applied to a papers, boards or card product. One mark can be awarded for a correct given advantage without description or example. Responses could be based upon: 1. A wax coating may be applied to duplex board (1) to improve the board's resistance to moisture, such as a takeaway container. (1) 2. Spirit / UV Varnishing may be applied to a board (1) to protect board products from wear and tear. (1) 3. UV Varnishing may be applied to newsprint paper (1) to improve its aesthetic appearance, such as a glossy magazine cover. (1) 4. A wax coating may be applied to duplex board (1) to keep the product fresh inside by creating a barrier to the atmosphere, such as a cake box. (1) 5. Embossing / debossing can be applied to a range of products (1) to create a raised profile/ impression for aesthetic purposes. (1) <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Papers, Board and Card	AO	Total
			Question or outline of question / Marking scheme		
(iii)			The image below shows a piece of hand-held equipment that is used to cut cardboard. State the correct name of the equipment shown. [1] <i>Only acceptable answers for this piece of equipment:</i> Craft Knife, Stanley Knife	AO4 2c [1]	1
(iv)			Accuracy is important when cutting cardboard. In the space below, use words and sketches to show how the puzzle frame pictured below can be marked out and cut precisely and accurately using hand tools and equipment. [4] Award up to 4 marks for answers that demonstrate a clear understanding of the stages needed to cut the border frame. Award a maximum of 2 marks for clear sketching of processes even if written communication is missing. <i>Answers provided may include:</i> 1. Draw out the border design accurately using steel rule and compass for rounded edges (1) 2. Place cardboard on a cutting mat. (1) 3. Using a compass cutter cut out the four edges in the corners of the puzzle internal and external (1) 4. Using a safety rule and a craft knife/scalpel cut the linear parts of the puzzle frame (1) <i>Credit any other appropriate response.</i>	AO4 2c [4]	4

Q	Science	Maths	Papers, Board and Card	AO	Total
			Question or outline of question / Marking scheme		
(b) (i)			The 20-piece puzzle below fits into a frame which has a 10mm border. Calculate the length of side A on the diagram. [1] One mark awarded for the correct answer: $180\text{mm} + 20\text{mm} = \mathbf{200\text{mm}}$	AO4 1b [3] AO4 1c [2]	5
(ii)			A die cutter is used to cut the 16-piece puzzle below from a cardboard roll. The cardboard roll is 1 metre wide. Calculate the length of cardboard roll needed to manufacture 500 puzzles in metres. <i>Show all workings.</i> [4] 1 metre = 1000mm $1000/200 = 5$ (5 puzzles will fit along the width of the roll.) [1] 500 puzzles divided by 5 = 100 rows of puzzles [1] $100 \text{ rows} = 100 \times 200 = 20000$ [1] Answer = 20 metres [1] <i>Credit any other appropriate approach to these calculations.</i>		

Q	Science	Maths	Papers, Board and Card	AO	Total															
			Question or outline of question / Marking scheme																	
(c)			In commercial design and manufacture, prototypes of card puzzles may be laser cut. Analyse the advantages and disadvantages of laser cutting card. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting card. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages and disadvantages of laser cutting card. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the advantages and disadvantages of laser cutting card. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td colspan="3">Award 0 marks for incorrect or irrelevant answers.</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Advantages of cutting card using the laser cutter:</i> • Most card can be cut with a laser cutter therefore offers flexibility; • Any thickness of card can be laser cut; • Card can be laser cut to any shape no matter how intricate the design;		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting card. 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 the advantages and disadvantages of laser cutting card. 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 the advantages and disadvantages of laser cutting card. 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	Papers, Board and Card Question or outline of question / Marking scheme	AO	Total
			• Precision achieved (+/- 0.1mm) – guarantees card designs with pieces will fit together, increasing quality assurance of end product; • Cards are cut accurately and provide clean lines on laser cutting; • Needs little manpower to operate; • Contactless and safe machinery (the laser cutter will stop if lid is opened mid cycle and will not cut if the lid is open); • Repeat cutting is possible on the laser cutter; • Modifications can be made to the original design and prototyped again; • The prototype can be cut quickly enabling the designer to have a working prototype. <i>Disadvantages of cutting card using the laser cutter:</i> • There will be a limit to how big the card can be cut based on the laser bed size; • Staining from bed plate can transfer on to the card; • Ventilation system needs to be installed to dispose of fumes; filters need replacing; • Expense of buying laser cutter; • Expense of buying and installing software/laser cutter; • Expense of servicing and maintenance of laser cutter; • Expensive to fix if laser is damaged or parts need replacing; • Laser cut settings are different for each card type and thickness; incorrect settings can damage the card or set fire to the card– wastage; • Training needed for correct operational use of the laser cutter. <i>Credit any other appropriate response. Answers must include both advantages and disadvantages to access the full 5 marks.</i>		

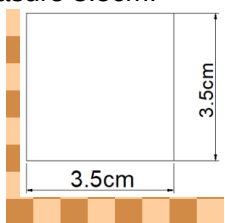
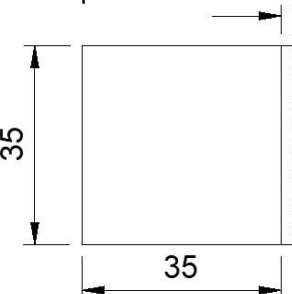
Q	Science	Maths	Papers, Board and Card	AO	Total															
			Question or outline of question / Marking scheme																	
(d)			Discuss how designers can improve and extend the life of papers, boards and card products to lessen their impact on our environment. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of papers, board and card products to lessen the impact on our environment. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to discuss how designers can extend the life of papers, board and card products to lessen the impact on our environment. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to discuss how designers can extend the life of papers, board and card products to lessen the impact on our environment. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers.</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below. <i>Examples of how improving and extending the life of papers, boards and card products can lessen the impact on our environment:</i> • Design less single use products; • Encourage social media bloggers to promote sustainable packaging; • Improve quality of raw materials and quality of construction/manufacture so products last longer;		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of papers, board and card products to lessen the impact on our environment. 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 discuss how designers can extend the life of papers, board and card products to lessen the impact on our environment. 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 discuss how designers can extend the life of papers, board and card products to lessen the impact on our environment. 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																			
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	Award 0 marks for incorrect or irrelevant answers.																			

Q	Science	Maths	Papers, Board and Card	AO	Total
			Question or outline of question / Marking scheme		
			- Put recycling information on the product to inform and encourage people to do it; - Marketing – it becomes ‘fashionable’ to use sustainable products; - Design and make products from a single material rather than mixed which can’t be separated for recycling; - Use materials that are not processed in ways that damage the eco-system; - Use natural dyes); - Design/use finishes that extend the life of products and preserve the quality appearance on purchase; - Manufacture locally reducing transport costs and CO2 emissions; - Use greener energy in the manufacture of clothing; - Purchase raw materials from Fair Trade suppliers/producers; - Educate in schools and colleges the detrimental effects of disposing products, encouraging employment of the 6R’s. <i>However:</i> - Some papers, board and card can be difficult to recycle due to multi-materials such as foil lined board; - Not all places such as town centres have recycling bins and therefore people put their paper, board and card rubbish in normal bins; - People don’t have choice - alternatives, such as sustainable materials, better quality manufacture and the like, are more costly to produce. Economical constraints in households are challenging at this time, people can only afford cheap products and is often poorly constructed; - Consumers often don’t consider the packaging of products and see it as something you dispose of; - Set-up costs to change manufacturing systems to become more environmentally friendly is expensive; - Developing countries will not benefit from reduced production rates; - Employment/jobs may become reduced leading to unemployment rates rising. <i>Credit any other appropriate response.</i>		
				Total	25

Question 6: Natural and manufactured timber

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The picture below shows a chess board. The top layer of the chessboard is made from reused hardwoods and softwoods. In the table below give an example of a hardwood and a softwood. 2 x [1] Hardwood Examples: Oak, Mahogany, Ash, Beech, Maple, Ebony, Walnut. (Common Types) Softwood Examples: Pine, Cedar, Larch, Fir, Redwood, Spruce, Yew. (Common Types) <i>Credit any other appropriate response.</i> Do not accept any manmade boards examples: MDF, plywood, chipboard, fibreboard etc.	AO4 1a [1] AO4 1b [1]	2 x [1]
(ii)			Wood fibres can be compressed and glued together to make manmade boards. Describe one advantage of using manmade boards. [2] Manufactured boards are man made by using solid timber fibres, strands and particles being glued together. 2 marks for describing one advantage of using manmade boards. One mark can be awarded for a correct given advantage without description or example. Responses could be based upon: 1. Various sizes of boards can be created for different uses (1) 2. Various thicknesses can be created (1) 3. There is no grain so a smoother finish can be achieved (1) 4. Less waste/no waste as manmade boards are made from fibres etc. (1) 5. Cheaper to buy than solid woods (1) 6. Can be made to be weather resistant using different types of glue (1) <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Natural and manufactured timber	AO	Total
			Question or outline of question / Marking scheme		
(iii)			The image below shows a piece of hand-held equipment used to cut the wooden squares of the chessboard. State the correct name of the equipment. [1] <i>Only acceptable answers for this piece of equipment: Tenon Saw. (Also accept dovetail saw / backsaw)</i>	AO4 2c [1]	1
(iv)			Precise construction is important when producing the chessboard. In the space below, use words and sketches to show how the chessboard's top layer is constructed. [4] Award up to 4 marks for answers that demonstrate a clear understanding of the stages needed to saw the two types of wood into squares. Award a maximum of 2 marks for clear sketching of processes even if written communication is missing. <i>Answers provided may include:</i> 1. Measuring and marking out the squares with a rule and try square or a jig or template. (1) 2. Allowance made for saw cuts. (1) 3. Cut using tenon saw or another appropriate saw. (1) 4. Sand edges using a disc sander or sand paper and sanding block. (1) 5. Glue together with PVA glue and clamp together on a base board. (1) 6. Position of wooden blocks with grain of wood running in the same direction. (1) 7. Wipe clean any over spillage of PVA glue so that the adding a finish is not affected or sanding surfaces of the chess board prior to finish. (1) Some sketches and stages required for full marks. <i>Credit any other appropriate response.</i>	AO4 2c [4]	4

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
(b) (i)		5	The chessboard is made from 64 equally sized squares of wood. The sides of each wooden square measure 3.5cm.  Overall length Calculate the overall length of the chessboard. [1] Answer: 8 squares at 3.5cm = $8 \times 3.5\text{cm} = 28\text{cm}$ <u>Correct answer = 28cm.</u> The squares of the chessboard are cut from lengths of wood that are 3.5cm wide.  35 35 saw allowance 2mm Calculate the total length of hardwood and softwood needed to manufacture 25 chessboards. [4] <i>Show all workings</i> There are 32 squares of hard / soft wood required (1) Each square is 35mm + 2mm = 37mm (1) $32 \times 37 = 1184\text{mm}$ (1) $1184 \times 25 \text{ chessboards} = 29,600\text{mm}$, or 2960cm or 29.6m (1) Note: If the candidate assumes the calculation involves both the length of the hardwood and the length of the softwood, do not penalise.	AO4 1b [3] AO4 1c [2]	5

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total															
			There are 64 squares, in total, of hard wood and softwood require (1) Each square is 35mm + 2mm = 37mm (1) 64 x 37mm = 2368mm (1) 2368 x 25 chessboards = 59,200mm or 59.2m (1) <i>All workings should be shown to illustrate how the answer was reached.</i>																	
(c)			In commercial manufacture, timbers can be laser cut. Analyse the advantages and disadvantages of laser cutting timbers. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting the wooden squares or veneers for each chessboard. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages and disadvantages of laser cutting the wooden squares or veneers for each chessboard. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the advantages and disadvantages of laser cutting the wooden squares or veneers for each chessboard. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td colspan="3">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Advantages of cutting the wooden squares or veneers for each chessboard using the laser cutter:</i> Improved accuracy as all wooden squares or veneers would be identical;		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting the wooden squares or veneers for each chessboard. 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 the advantages and disadvantages of laser cutting the wooden squares or veneers for each chessboard. 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 the advantages and disadvantages of laser cutting the wooden squares or veneers for each chessboard. 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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Award 0 marks for incorrect or irrelevant answers																				

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
			• No need to allow for a saw cut although some allowance would need to be made for the width of the laser cut; • Veneers could be laser cut instead of using solid wood in order to reduce cost; • The layout of the chessboard could be marked out or engraved using the laser cutter in order to make construction easier; • The chessboard could be laser cut from a manmade board such as laser plywood or laser MDF as well in order to reduce the cost of manufacture; • Precision achieved (+/- 0.1mm) – guarantees wooden pieces or veneers will fit together, increasing quality assurance of end product; • More than one thickness of wood can be laser cut, speeding up the cutting production process; • Needs little manpower to operate; • No mechanical friction which limits wear and tear of component parts; • Contactless and safe machinery (the laser cutter will stop if lid is opened mid cycle and will not cut if the lid is open). <i>Disadvantages of cutting wooden squares or veneers for each chessboard using the laser cutter:</i> • There will be a limit to how big the wooden shapes or veneers shapes can be cut based on the laser bed size. • The edges of the wood or veneers will be burnt and dark so may require extra finishing; • Laser cutting will produce burn marks on the surface of the material and this will have to be removed by sanding the marks off; • Staining from bed plate can transfer on to the wood; • Natural materials smell when laser cut. Note: this smell disappears over time; • Some manmade boards cannot be laser cut due to the glues used which may be flammable, melt or create fumes that will damage the laser cutter; • Ventilation system needs to be installed to dispose of fumes; filters need replacing; • Expense of buying laser cutter; more expensive than CNC routers; • Expense of buying and installing software/laser cutter; • Expense of servicing and maintenance of laser cutter; • Expensive to fix if laser is damaged or parts need replacing; • Laser cut settings are different for each type of material and thickness; incorrect settings can damage the material or allow it to catch fire – creates more wastage or is a fire/H&S hazard;		

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total															
			Training needed for correct operational use of the laser cutter. <i>Credit any other appropriate response. Answers must include both advantages and disadvantages to access the full 5 marks.</i>																	
(d)			Discuss how designers can improve and extend the life of wooden products to lessen their impact on our environment. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of wood-based products to lessen the impact on our environment. There will be evidence of relevant examples and well-developed substantiated judgements in a response, which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to discuss how designers can extend the life of wood-based products to lessen the impact on our environment. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response, which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to discuss how designers can extend the life of wood-based products to lessen the impact on our environment. There will be limited evidence of relevant examples or judgements in a response, which demonstrates little structure.</td><td>1-2</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below.		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of wood-based products to lessen the impact on our environment. 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 discuss how designers can extend the life of wood-based products to lessen the impact on our environment. 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 discuss how designers can extend the life of wood-based products to lessen the impact on our environment. 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																			
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Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
			<i>Examples of how improving and extending the life of wood-based products can lessen the impact on our environment:</i> • Manufactured boards are by-products of converting natural timber from trees; • Laminating / adding specialist layers / finishes e.g. Formica – kitchen worktops • Wooden products can be recycled and used to create new manmade boards; • Manmade boards can also be recycled and regenerated into new sheets of material; • Improve quality of finish, strength and quality of construction/manufacture so products last longer; • Design products that can be repaired so that parts can be replaced in order to extend the life span of the product; • Use woods that are sustainable and from managed sources; • Design and manufacture wooden products that have been made from recycled or up cycled wood; • Design/use suitable finishes that extend the life of products and preserve their quality of appearance on purchase; • Manufacture raw materials locally reducing transport costs and CO2 emissions; • Use greener energy in the manufacture of wooden products; • Purchase raw materials from managed/responsible sources suppliers/producers; • Educate in schools and colleges the detrimental effects of disposing of materials such as wood in landfill, encouraging employment of the 6R's; • Although natural woods can biodegrade, the glues used can contaminate land and it is waste that can be regenerated and used as a raw material again; <i>Credit any other appropriate response.</i>		
				Total	25

Question 6: Ferrous and Non-Ferrous Metals

Q	Science	Maths	Ferrous and Non-Ferrous Metals Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The chess set shown below includes chess pieces manufactured from recycled metals. The metals used for the chess pieces are made from ferrous and non-ferrous metals. In the table below give an example of a ferrous and a nonferrous metal. 2 x [1] Ferrous Metals Examples: Steel, Carbon Steel, Cast Iron, Wrought Iron (Accept alloys of iron such as stainless steel) Iron is also acceptable. (<i>Common Types</i>) Non Ferrous Metals Examples: Aluminium, copper, lead, zinc, Nickel, Tin, Titanium, gold, silver, platinum (Accept copper alloys such as brass & bronze) Pewter (tin based) is also acceptable. (<i>Common Types</i>) <i>Credit any other appropriate response.</i>	AO4 1a [1] AO4 1b [1]	2 x [1]
(ii)			Metals can be combined to produce an alloy. Describe one advantage of using an alloy. [2] An alloy is made up of a number of metals. When mixed together they combine the properties of both materials. Examples of common alloys – Examples of alloys include red gold (gold and copper), white gold (gold and silver), sterling silver (silver and copper), steel or silicon steel (iron with non-metallic carbon or silicon respectively), solder, brass, pewter, duralumin, bronze, and amalgams. Candidates may name an alloy as an example to exemplify their answer. Advantage of Alloys may include the benefits of the following: 1. Enhance the working properties and characteristics of the material. 2. Corrosion resistance. 3. Better solderability. 4. Durable parts. 5. Lighter weight for the strength.	AO4 2b [2]	2

Q	Science	Maths	Ferrous and Non-Ferrous Metals Question or outline of question / Marking scheme	AO	Total
			6. Thermal conductivity. 7. Electrical conductivity. <i>Credit any other appropriate response.</i>		
(iii)			The image below shows a piece of machinery used to manufacture the chess pieces. State the correct name of the machine shown. [1] <i>Only acceptable answers for this piece of equipment: <u>Centre Lathe. (accept Lathe)</u></i>	AO4 2c [1]	1
(iv)			Precise construction is important when producing chess pieces. In the space below use words and sketches to show how one of the chess pieces could be manufactured using the machine shown.[4] Award up to 4 marks for answers that demonstrate a clear understanding of the stages needed to machine one of the chess pieces. Award a maximum of 2 marks for clear sketching of processes even if written communication is missing. <i>Answers provided may include:</i> • Hold material in chuck. (1) • Set up correct cutting tool for turning and set correct speed & feed of lathe. (1) • Face off bar and turn around in the chuck. Base of piece. (1) • Turn/cut (TAPER TURN) the shape of chess piece using the axis of the lathe and a profile template for accuracy. (1) • Part off the chess piece for use. (1) <i>Credit any other appropriate response.</i>	AO4 2c [4]	4

Q	Science	Maths	Ferrous and Non-Ferrous Metals Question or outline of question / Marking scheme	AO	Total
(b) (i)		5	The chessboard is made from 64 equally sized squares. The sides of each square measure 3.5cm. There is also a 2cm border around the edge of the board.  The chessboard is fixed together into a frame to make a complete chessboard. Calculate the length of the chessboard including the frame. <i>Show all workings.</i> [1] Answer: 8 squares at 3.5cm = $8 \times 3.5\text{cm} = 28\text{cm}$ (+ 2cm border each side) + 4cm = 32cm <u>Correct answer = 32cm.</u>	AO4 1b [3] AO4 1c [2]	5
(ii)			The 16 small chess pieces each require 3 cm of rod and the 16 larger pieces each require 5 cm of rod. An allowance of 35 mm is required for each piece. Calculate the total length of metal rod needed to manufacture each set of 32 chess pieces. [4] X16 small pieces $\times 3\text{cm} = 48\text{cm}$ (1) X16 large pieces $\times 5\text{cm} = 80\text{cm}$ (1) 32 $\times$ allowance 3.5cm / 35mm = 112cm (1) Total Length of bar $48 + 80 + 112 = 2400\text{mm}$ or 240cm or 2.4m (1) <i>All workings should be shown to illustrate how the answer was reached.</i>		

Q	Science	Maths	Ferrous and Non-Ferrous Metals Question or outline of question / Marking scheme	AO	Total															
(c)			In commercial manufacture, chess pieces can be CNC machined. Analyse the advantages and disadvantages of CNC machining the chess pieces. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of CNC machining the metal chess pieces for each chess set. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages and disadvantages of CNC machining the metal chess pieces for each chess set. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the advantages and disadvantages of CNC machining the metal chess pieces for each chess set. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Advantages of CNC machining the metal chess pieces for each chess set using a CNC lathe:</i> • Improved accuracy as all different types of chess pieces would be identical • Different coloured pieces could be produced by changing the material on the machine;		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of CNC machining the metal chess pieces for each chess set. 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 the advantages and disadvantages of CNC machining the metal chess pieces for each chess set. 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 the advantages and disadvantages of CNC machining the metal chess pieces for each chess set. 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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BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the advantages and disadvantages of CNC machining the metal chess pieces for each chess set. There will be limited evidence of relevant examples or a logical chain of reasoning.	1																		
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Q	Science	Maths	Ferrous and Non-Ferrous Metals Question or outline of question / Marking scheme	AO	Total
			• Multiple parts could be produced reducing waste and material to be held in the lathe's chuck in order to reduce cost; • Each set of chess pieces could be manufactured quicker and with improved accuracy; • Precision achieved (+/- 0.1mm) – guarantees quality and accuracy of parts produced using the lathe; pieces or veneers will fit together, increasing quality assurance of end product; • Needs little manpower to operate; • Speeds and feeds can be set easily on the machine and can be varied using CAM; • Lathe operations can be sequenced and programmed for quicker manufacturing avoiding tool changes; • Contactless and safe machinery (the CNC lathe will stop if guarding is opened mid cycle and will not machine if the guard is open); • The edges of the chess pieces will have a better finish avoiding the need for any extra finishing. <i>Disadvantages of CNC machining the metal chess pieces for each chess set using a CNC lathe:</i> • There will be a limit to how big the metal chess pieces can be turned based on the size of lathe; • Waste material is produced when machining parts; • Expense of buying CNC Lathe; • Expense of buying and installing software/CNC Lathe; • Expense of servicing and maintenance of CNC Lathe; • Expensive to fix if CNC Lathe is damaged or parts need replacing; • CNC Lathe settings are different for each type of material and profile; incorrect settings can damage the material or lathe – creates more wastage and or a H&S hazard; • Training needed for correct operational use of the CBC Lathe; • Cannot/ should not be left unattended; • Time and cost of training somebody to use the CNC lathe; as this is a skilled job. <i>Credit any other appropriate response. Answers must include both advantages and disadvantages to access the full 5 marks.</i>		

Q	Science	Maths	Ferrous and Non-Ferrous Metals Question or outline of question / Marking scheme	AO	Total															
6(d)			Discuss how designers can improve and extend the life of metal products to lessen their impact on our environment. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of metal-based products to lessen the impact on our environment. There will be evidence of relevant examples and well-developed substantiated judgements in a response, which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to discuss how designers can extend the life of metal-based products to lessen the impact on our environment. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response, which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to discuss how designers can extend the life of metal-based products to lessen the impact on our environment. There will be limited evidence of relevant examples or judgements in a response, which demonstrates little structure.</td><td>1-2</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below. <i>Examples of how improving and extending the life of metal-based products can lessen the impact on our environment:</i>		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of metal-based products to lessen the impact on our environment. 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 discuss how designers can extend the life of metal-based products to lessen the impact on our environment. 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 discuss how designers can extend the life of metal-based products to lessen the impact on our environment. 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 discuss how designers can extend the life of metal-based products to lessen the impact on our environment. 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 discuss how designers can extend the life of metal-based products to lessen the impact on our environment. 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 discuss how designers can extend the life of metal-based products to lessen the impact on our environment. 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																			

Q	Science	Maths	Ferrous and Non-Ferrous Metals Question or outline of question / Marking scheme	AO	Total
			• Designers can be efficient – select manufacturers and production processes that are energy efficient, try to reduce inputs such as water and chemicals and use green, renewable energy; • Make products multifunctional – encourage customers to do more with less through multifunctional design; • Manufacture products from recycled metal preventing it going to landfill; • Use materials that can be reformed into stock shapes such as wires, bars, sheets, and rods; • Products could be made from aluminium cans. The metal can be reformed for use to make new products; • Steel is another example that can be recycled to make new products; • Minimise the amount of metals going to landfill by recycling them to make new products; • Another example could be Apple recycling their aluminium to recreate products. <i>Credit any other appropriate response.</i>		
				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)			The product pictured below is a stand for a mobile phone. The phone stand is made from a thermoforming polymer. Polymers also can be classed as thermosetting polymers. In the table below, state the name of a thermoforming and a thermosetting polymer. [2] Thermoforming Polymer: Acrylic, Polyethylene, HDPE, LDPE, PVC, PET, Polypropylene Thermosetting Polymer: Urea Formaldehyde, Melamine Formaldehyde, Polyester Resin <i>Credit any other appropriate response.</i>	AO4 1a [1] AO4 1b [1]	2 x [1]
(ii)			Thermosetting polymer resins can be combined with fibres. Describe one advantage of adding fibres to a thermosetting polymer. [2] Up to 2 marks can be awarded for a described advantage as to why polymers might have fibres added. One mark can be awarded for a correct given advantage without description or example. Responses could be based upon: 1. Adding fibres to thermosetting polymers can provide high strength (1) for example polyester resin in boating (1) 2. Adding fibres to thermosetting polymers provide high strength whilst being lightweight (1) for example, glass fibre on yachts where high strength and lightweight is the desired property (1) 3. Adding carbon fibre for thermosetting polymers increase impact resistance (1) for example, in bike helmets where safety is the primary concern for the rider (1). <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Thermosetting and Thermoforming Plastics	AO	Total
			Question or outline of question / Marking scheme		
(iii)			The image below shows a hand-held tool used to shape the edges of sheet polymers. State the correct name of the equipment shown. [1] <i>Only acceptable answers for tool:</i> Hand File, Flat File, Half round file	AO4 2c [1]	1
(iv)			Accuracy is important when line bending sheet polymers. In the space below, use words and sketches to show how the sheet polymer phone stand can be bent precisely and accurately. [4] Award up to 4 marks for answers that demonstrate a clear understanding of the stages needed to line bend sheet polymer. Award a maximum of 2 marks for clear sketching of processes even if written communication is missing. <i>Answers provided may include:</i> 1. Mark out the lines to be bent with a try square to ensure the line will be heated accurately at 90° (1) 2. Place the sheet on the strip heater/line bending machine – [wear heat resistant gloves] (1) 3. Wait until the sheet polymer has become softened (1) 4. Hold / keep the sheet accurately at the required angle (1) (accept jig) 5. Wait until the sheet polymer has cooled (1) 6. Repeat the process until all the lines that needed bending have been bent (1). <i>Credit any other appropriate response.</i>	AO4 2c [4]	4

Q	Science	Maths	Thermosetting and Thermoforming Plastics Question or outline of question / Marking scheme	AO	Total
(b) (i)		5	The design of the phone stand is shown below: The phone stand has been designed to hold a mobile phone with a thickness which is 10mm. Calculate the length of side A. [1] One mark awarded for the correct answer: 160mm + 20mm + 10mm for the mobile phone = 190mm (ii) One sheet of polymer that fits the laser cutter is 600mm x 600mm. Calculate how many sheets would be needed to laser cut 84 phone stands. [4] <i>Show all workings</i> 600/190 = 3.15. 3 phone stands fit down one length (1) 600/85 = 7.05. 7 phone stands fit down one length (1) 7 x 3 = 21. 21 Phone stands will fit onto one sheet (1) 84/21 = 4. 4 sheets would be required to make 84 phone stands (1) <i>Allow for calculation forwarding errors from 6 (b)(i)</i> <i>Credit any other appropriate approach to these calculations.</i>	AO4 1b [3] AO4 1c [2]	5

Q	Science	Maths	Thermosetting and Thermoforming Plastics	AO	Total															
			Question or outline of question / Marking scheme																	
(c)			In commercial manufacture, sheet polymer products can be laser cut. Analyse the advantages and disadvantages of laser cutting sheet polymers. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting sheet polymers. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages and disadvantages of laser cutting sheet polymers. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the advantages and disadvantages of laser cutting sheet polymers. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Advantages of cutting polymer using the laser cutter:</i> • Thermoforming sheet polymers are ideal for laser cutting; • A variety of thicknesses of polymer can be laser cut; • CO2 lasers provide a polished edge[self-finishing] on cutting; • Different polymers can be laser cut (at same or different times); • Polymers can be laser cut into any shape no matter how intricate the design;		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting sheet polymers. 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 the advantages and disadvantages of laser cutting sheet polymers. 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 the advantages and disadvantages of laser cutting sheet polymers. 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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BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages and disadvantages of laser cutting sheet polymers. 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 the advantages and disadvantages of laser cutting sheet polymers. There will be limited evidence of relevant examples or a logical chain of reasoning.	1																		
	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Thermosetting and Thermoforming Plastics Question or outline of question / Marking scheme	AO	Total
			• Precision achieved (+/- 0.1mm) –, increasing quality assurance of end product; • The laser cutter also enables the sheet polymer to be engraved; • Needs little manpower to operate; • Contactless and safe machinery (the laser cutter will stop if lid is opened mid cycle and will not cut if the lid is open). <i>Disadvantages of cutting polymer using the laser cutter:</i> • There will be a limit to how big the polymer sheet can be cut based on the laser bed size; • Some Polymers cannot be cut on the laser cutter such as PVC as it emits hydrochloric acid and toxic fumes; • Staining from bed plate can transfer on to polymer surface; • Ventilation system needs to be installed to dispose of fumes; filters need replacing; • Expense of buying laser cutter; • Expense of buying and installing software/laser cutter; • Expense of servicing and maintenance of laser cutter; • Expensive to fix if laser is damaged or parts need replacing; • Laser cut settings are different for each thickness of polymer sheet; incorrect settings can damage the edge of the polymer sheet; • Training needed for correct operational use of the laser cutter. <i>Credit any other appropriate response. Answers must include both advantages and disadvantages to access the full 5 marks.</i>		

Q	Science	Maths	Thermosetting and Thermoforming Plastics	AO	Total															
			Question or outline of question / Marking scheme																	
(d)			Discuss how designers can improve and extend the life of polymer products to lessen their impact on our environment. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of polymer products to lessen the impact on our environment. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to discuss how designers can extend the life of polymer products to lessen the impact on our environment. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to discuss how designers can extend the life of polymer products to lessen the impact on our environment. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below. <i>Examples of how improving and extending the life of polymer products can lessen the impact on our environment:</i> • Use thermoforming polymers when making products as they are recyclable, whereas thermosetting polymers aren't.		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of polymer products to lessen the impact on our environment. 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 discuss how designers can extend the life of polymer products to lessen the impact on our environment. 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 discuss how designers can extend the life of polymer products to lessen the impact on our environment. 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 discuss how designers can extend the life of polymer products to lessen the impact on our environment. 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 discuss how designers can extend the life of polymer products to lessen the impact on our environment. 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 discuss how designers can extend the life of polymer products to lessen the impact on our environment. 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																			

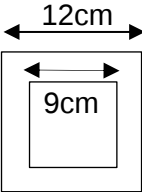
Q	Science	Maths	Thermosetting and Thermoforming Plastics Question or outline of question / Marking scheme	AO	Total
			• Design less fad products; • Encourage social media bloggers to promote sustainable polymers and recycling; • Improve quality of raw materials and quality of construction/manufacture so products last longer; • Design products that can be repaired (and that customers will want to repair). Include spare components to encourage repair; • Ensure all products are easy to care for and maintain; • Use polymers that are sustainable e.g. bio-plastics that can decompose over time and do not use a finite resource to make; • Design and manufacture polymers that have been made from recycled products; • Use natural pigments to add colour to the polymer in production; • Employ fewer fashionable products, so consumers are less likely to dispose of an older working product to follow a fad. • Some polymer products are classed as oxo-degradable which means they have additives that help them decompose with natural oxygen, sunlight; • Manufacture locally reducing transport costs and CO₂ emissions; • Use greener energy in the manufacture of polymer products; • Purchase raw materials from Fair Trade suppliers/producers; • Educate in schools and colleges the detrimental effects of disposing polymer products, encouraging employment of the 6R's <i>However:</i> • Although bio-plastics can biodegrade, they still take many years to do so and can emit gases; • Whilst oxo-degradable polymers have additives that help them decompose, the polymer just tends to fall into pieces rather than fully decompose; • Social media and the technological society we live in promotes design obsolescence; it is difficult to change people's long-term opinions as they may want the latest product; • Bio-plastics may be more eco-friendly because they do biodegrade, but they are grown with chemical pesticides and fertilisers which are toxic to our ecosystem; • People don't have choice - alternatives, such as bio-plastics, better quality manufacture and the like, are more costly to produce. Economical constraints in households are challenging at this		

Q	Science	Maths	Thermosetting and Thermoforming Plastics	AO	Total
			Question or outline of question / Marking scheme		
			time, people can only afford cheaper products and cheap products are often less well made and durable; • Synthetic materials may use fossil fuels in their manufacture; • Set-up costs to change manufacturing systems to become more environmentally friendly is expensive; • Developing countries will not benefit from reduced production rates; • Employment/jobs may become reduced leading to unemployment rates rising. <i>Credit any other appropriate response.</i>		
				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)			The products pictured below have been covered in recycled fabric made from sewn patchwork shapes. The fabrics used for the patchwork shapes are made from either synthetic or natural fibres. In the table below name an example of a synthetic and a natural fibre. [2] Synthetic Fibre Examples: Polyester; Nylon (Polyamide); Acrylic; Polypropylene; Tactel®; Elastane (Lycra®). Natural Fibre Examples: Cotton; Linen; Wool; Silk; Hemp; Jute. <u>No not accept regenerated fibre examples:</u> Viscose (Rayon); Tencel® <i>Credit any other appropriate response.</i>	AO4 1a [1] AO4 1b [1]	2 x [1]
(ii)			Synthetic fibres can be blended with natural fibres. Describe one advantage of fibre blending. [2] Up to 2 marks can be awarded for a described advantage as to why synthetics fibres can be blended with natural fibres. One mark can be awarded for a correct given advantage without description. Responses could be based upon: 1. Blending synthetic and natural fibres can improve the properties of the fabric (1) for example the fabric can become more crease resistant (1) 2. Blending synthetic and natural fibres can improve the aesthetics/texture of the fabric (1) for example the fabric can have a higher lustre or shine (1) 3. Blending synthetic and natural fibres can reduce the cost of the fabric (1) for example polyester is cheaper than cotton (1) 4. Blending synthetic and natural fibres can improve the function of the fabric (1) for example, blending with finer fibres can improve the drape of the fabric (1) 5. Blending synthetic and natural fibres can improve the quality of the fabric (1) for example, the fabric can become stronger (1). <u>Typical fibre blends:</u> Polyester/Cotton; Cotton/Elastane; Acrylic/Wool; Cotton/Wool. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Fibres and Textiles	AO	Total
			Question or outline of question / Marking scheme		
(iii)			The image below shows a piece of hand-held equipment used to cut the fabric patchwork shapes. State the correct name of the equipment shown. [1] <i>Only acceptable answer for this piece of equipment: Rotary Cutter/Blade.</i>	AO4 2c [1]	1
(iv)			Precise sewing is important when producing patchwork fabric. In the space below use words and sketches to show how two square patchwork shapes would be sewn together precisely and securely. [4] Award up to 4 marks for answers that demonstrate a clear understanding of the stages needed to sew two patchwork squares together. Award a maximum of 2 marks for clear sketching of processes even if written communication is missing. <i>Answers provided may include:</i> 1. Place patchwork squares together, right sides facing (1) 2. Mark 1.5cm seam allowance (1) 3. Stitch two patchwork shapes together using a 1.5cm seam allowance (1) 4. Use a running/straight stitch to sew (1) 5. Secure stitching using reverse stitching (or machine knot) (1) 6. Overlock seams (1) 7. Press seams to one side (or open) (1) <i>Credit any other appropriate process that precisely and securely sews two patchwork shapes together.</i>	AO4 2c [4]	4

Q	Science	Maths	Fibres and Textiles Question or outline of question / Marking scheme	AO	Total
(b) (i)		5	The front of the cushion is made from 16 equally sized squares of sewn fabric. Each square measures 9cm². Each patchwork square needs a seam allowance addition of 1.5cm. Calculate the length of one patchwork square with seam allowance added. [1] One mark awarded for the correct answer: 9cm + 3cm (1.5cm x 2) = 12cm  (ii) The patchwork squares are to be cut from fabric that is 240cm wide. Calculate the length of fabric needed to manufacture 400 patchwork cushion fronts. <i>Show all workings.</i> [4] 400 x 16 squares = 6,400 squares (1) 240/12 = 20 squares in one width of fabric (1) 6,400/20 = 320 (1) 320 x 12 = 3840cm or 38.4m (1) Note: fabric is normally sold in half-metre or whole metre lengths. (Accept exact answers or one rounded up to 38.5m) <i>Credit any other appropriate approach to the calculations.</i>	AO4 1b [3] AO4 1c [2]	5

Q	Science	Maths	Fibres and Textiles	AO	Total															
			Question or outline of question / Marking scheme																	
(c)			In commercial manufacture, fabric patchwork shapes are laser cut. Analyse the advantages and disadvantages of laser cutting fabric. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting fabric. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages and disadvantages of laser cutting fabric. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the advantages and disadvantages of laser cutting fabric. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Advantages of cutting fabric using the laser cutter:</i> - Any fabric type can be laser cut. For example, woven, knitted, felted; offers flexibility; - Any thickness of fabric can be laser cut. For example, lawn cotton, denim, leather; - Natural, synthetic and regenerated fabrics can be laser cut. For example, cotton, polyester, acetate; - Fabrics can be laser cut any shape no matter how intricate the design. Links may be made to decorative effects such as applique/reverse applique; - Precision achieved (+/- 0.1mm) – guarantees fabric pattern pieces will fit together, increasing quality assurance of end product;		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting fabric. 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 the advantages and disadvantages of laser cutting fabric. 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 the advantages and disadvantages of laser cutting fabric. 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																			
BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages and disadvantages of laser cutting fabric. 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 the advantages and disadvantages of laser cutting fabric. 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 the advantages and disadvantages of laser cutting fabric. There will be limited evidence of relevant examples or a logical chain of reasoning.	1																		
	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Fibres and Textiles Question or outline of question / Marking scheme	AO	Total
			• Synthetic and regenerated fabrics are ‘sealed’ on cutting (the synthetic component melts and then sets) removing the need to finish the fabric edges with overlocking; • Synthetic and regenerated fabrics do not fray on laser cutting (as above); • More than one thickness of fabric can be laser cut, speeding up the cutting production process; • Needs little manpower to operate; • Laser cutters can be used for more than just fabric granting manufacturers flexibility e.g. buttons could be laser cut; • No mechanical friction which limits wear and tear of component parts; • Contactless and safe machinery (the laser cutter will stop if lid is opened mid cycle and will not cut if the lid is open). <i>Disadvantages of cutting fabric using the laser cutter:</i> • There will be a limit to how big the fabric shapes can be cut based on the laser bed size. If being used for clothing pattern shapes, many are too big for a laser bed; • Natural fabrics have a singed edge on cutting which can produce staining/marks on the fabric (if settings are not perfectly correct); • Staining from bed plate can transfer on to fabric; • Natural fabrics smell (like burnt hair) on laser cutting. Note: this smell disappears over time or after washing; • Some fabrics cannot be laser cut due to toxic/carcinogenic properties (e.g. PVC coated fabrics) - toxic fumes emitted; • Ventilation system needs to be installed to dispose of fumes; filters need replacing; • Expense of buying laser cutter; more expensive than plasma or wet-jet lasers; • Expense of buying and installing software/laser cutter; • Expense of servicing and maintenance of laser cutter; • Expensive to fix if laser is damaged or parts need replacing; • Laser cut settings are different for each fabric type and thickness; incorrect settings can damage the fabric – wastage; • Training needed for correct operational use of the laser cutter. <i>Credit any other appropriate response. Answers must include both advantages and disadvantages to access the full 5 marks.</i>		

Q	Science	Maths	Fibres and Textiles	AO	Total															
			Question or outline of question / Marking scheme																	
6(d)			Discuss other ways designers can extend the life of textile products to lessen their impact on our environment. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of textile products to lessen the impact on our environment. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to discuss how designers can extend the life of textile products to lessen the impact on our environment. There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to discuss how designers can extend the life of textile products to lessen the impact on our environment. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td colspan="3">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive, and candidates are not expected to refer to all the material identified below. <i>Examples of how extending the life of textile products can lessen the impact on our environment:</i> • Design less fashion led clothing; • Design clothes that are stylish and do not follow trends;		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to discuss how designers can extend the life of textile products to lessen the impact on our environment. 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 discuss how designers can extend the life of textile products to lessen the impact on our environment. 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 discuss how designers can extend the life of textile products to lessen the impact on our environment. 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 discuss how designers can extend the life of textile products to lessen the impact on our environment. 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 discuss how designers can extend the life of textile products to lessen the impact on our environment. 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 discuss how designers can extend the life of textile products to lessen the impact on our environment. 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																				

Q	Science	Maths	Fibres and Textiles	AO	Total
			Question or outline of question / Marking scheme		
			• Encourage social media bloggers to promote sustainable clothing; • Improve quality of raw materials and quality of construction; • Manufacture so clothes last longer – quality of manufacture; • Design clothing with an iconic style – clothes can be stored but still re-used; • Design clothes that can be repaired (customers want to repair) include spare components like buttons and matching thread for the repairs; • Marketing – it becomes fashionable to make do and mend; • Design clothes that fit multiple body shapes / sizes, helping reach a wider audience; • Assure all clothes are easy to care for. Clothes that do not rely on dry cleaning services. Make care label labels clear to avoid damage to clothing whilst being cared for and/or labels that encourage recycling/reuses/repairing; • Use fabrics that are sustainable e.g., Bamboo which biodegrades, grows rapidly / easily, needs no chemical intervention for successful production; • Design and make clothes from old / upcycled clothing; • Use organic fibres, those that are not processed, in ways that do not damage the eco-system; • Use natural dyes or gaseous dying techniques (removing need for water); • Design fabric finishes that extend life of clothing, and preserve quality / appearance on purchases; • Employ less fashion seasons. There are up to 14 seasons per year, encouraging a throw away / waste culture; • Manufacture locally to reduce transport costs and CO² emissions; • Use greener energy in manufacture of clothing; • Use fair trade supplier or producers; • Educate in schools and colleges about effects of disposing of clothing encouraging employment of 6Rs.		

Q	Science	Maths	Fibres and Textiles	AO	Total
			Question or outline of question / Marking scheme		
			<i>However:</i> • Although natural fabrics can biodegrade, they still take many years to do so; • Social media and the technological society we live in promotes high fashion; it is difficult to change people's long-term opinions on following fashion trends; • Natural fibres may be more eco-friendly because they do biodegrade faster than synthetic fabrics, however, they are grown with chemical pesticides and fertilisers which are toxic to our ecosystem; • So much water is used to process natural fibres into fabrics; • Synthetic materials may use fossil fuels to manufacture them, but they need little processing, little water is used and much less energy. They are also durable and long lasting. <i>Credit any other appropriate response.</i>		
				Total	25