



GCE AS MARKING SCHEME

SUMMER 2023

**AS (NEW)
DESIGN AND TECHNOLOGY - PRODUCT DESIGN
2603U10-1**

INTRODUCTION

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

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

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

GCE DESIGN & TECHNOLOGY
ENGINEERING DESIGN - UNIT 1
SUMMER 2023 MARK SCHEME

Guidance for examiners

Positive marking

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

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

Banded mark schemes

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

The indicative content suggests the range of 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.

In Design and Technology, each question addresses one assessment objective: either AO3 or AO4. The assessment grid sub-divides the total mark to allocate for a question. These are shown in bands in the mark scheme. 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 provided.

GCE DESIGN & TECHNOLOGY

PRODUCT DESIGN - UNIT 1

SUMMER 2023 MARK SCHEME

Question 1	The set of polymer food storage boxes below include a box and lid.				
	AO3	AO4	Mark		
(a)	Discuss how the design of the polymer food storage boxes uses space effectively.			✓	[4]
		<p><i>The response must discuss effective use of space in the design of the polymer food boxes.</i></p> <p><i>Response could refer to:</i></p> <ul style="list-style-type: none"> • <i>The boxes fit inside each other</i> • <i>Each box is smaller than the previous box</i> • <i>The lid clips on the top of each box</i> • <i>The lid clips inside each other.</i> <p>Guidance to markers</p> <p><i>Incorrect/ no response</i> 0</p> <p><i>Identification of a design factor, no discussion</i> 1</p> <p><i>Identification of a design factor, with discussion</i> 2</p> <p>Example</p> <p><i>Incorrect/ no response</i> 0</p> <p><i>The boxes all fit inside each other.</i> 1</p> <p><i>The boxes are designed to fit inside each other this allows them to be stacked efficiently saving space.</i> 2</p> <p><i>Each box is smaller than the others this allows the boxes to fit inside each other and reduces the space required in a cupboard for storage. The lids clip together on top of the boxes.</i> 3</p> <p><i>The storage boxes have been reduced in size and designed to fit easily inside each other allowing them to be stacked inside of each other when they are empty. The lids will also clip together on the top of each container in an organised way and this reduces the space needed in the cupboard for the storage of the boxes and lids.</i> 4</p>			

		AO3	AO4	Mark
(b)	The food storage containers have been injection moulded.		✓	
(i)	<p>Explain one essential requirement of the surface finish of the containers for the user.</p> <p><i>The response must explain what the user requires from the surface finish of the polymer food boxes.</i></p> <p><i>The inside of the boxes must be smooth to allow for easy cleaning and prevent food/bacteria from lodging in crevices.</i></p> <p><i>Incorrect/ no response</i></p> <p>Example:</p> <p><i>Statement of a surface finish:</i> <i>The inside must be smooth.</i> <i>The handles must be textured.</i></p> <p><i>Finish explained:</i> <i>The inside must be smooth and hygienic and allows for easy cleaning.</i> <i>The handles must be textured to allow the user to grip them easily when trying to open the lid.</i></p> <p>Two statements only award 1 mark</p>			<p>[2]</p> <p>0</p> <p>1</p> <p>2</p>
(ii)	<p>Describe a critical feature of the mould for the manufacture of the containers.</p> <p><i>The response must describe critical features of a successful mould.</i></p> <p><i>The internal surface texture of the mould cavity must be of a very high quality and reflect the surface texture required for the finished container.</i></p> <p><i>Incorrect/ no response</i></p> <p>Example:</p> <p><i>Statement of a feature:</i> <i>The mould must be textured</i> <i>The mould must be able to be split apart.</i></p> <p><i>Feature described:</i> <i>The surface texture of the mould cavity must reflect the required texture of the finished containers.</i> <i>The mould must be in two parts allowing the container to be removed easily.</i></p> <p>Two features stated but no description only award 1 mark</p>			<p>[2]</p> <p>0</p> <p>1</p> <p>2</p>

Question 2		Material development is advancing, and designers have access to a range of new smart materials.		
		AO3	AO4	Mark
(a)	Explain the term 'smart material'.		✓	[2]
<p><i>The response must demonstrate understanding of the term 'Smart Material'.</i></p> <p><i>Materials that can respond to an external stimulus or environment. Stimulus could be Light, Electricity, sudden force, etc.</i></p> <p><i>Incorrect/ no response</i></p> <p>Example:</p> <p><i>A material that responds to an external stimulus.</i></p> <p><i>A material that responds to an external stimulus such a change in temperature.</i></p> <p>Accept any other appropriate response</p>				0
				1
				2
		AO3	AO4	Mark
(b)	Name a smart material that could be used in the lenses of the product shown below.		✓	[1]
<p><i>The response must identify an appropriate type of smart material or property.</i></p> <p><i>Photochromic pigment</i></p> <p><i>Reactalight</i></p> <p><i>Incorrect/ no response</i></p> <p><i>Photochromic dye or pigment</i></p> <p>Accept any other appropriate response.</p>				0
				1

		A03	A04	Mark
(c)	The frames are made from a shape memory alloy. Discuss how this smart material will improve the functionality and lifespan of the frame.		✓	[5]
	<p><i>The response must demonstrate understanding of the use of the Smart Material has improved the function of the product.</i></p> <p>Example: <i>Nitinol is a shape memory alloy with super elastic properties that will return to its original shape after is has been deformed, bent, twisted etc.</i> <i>In the case of glasses this means that the frame may not be broken accidentally from dropping, crushing etc.</i> <i>The elastic properties will allow for greater comfort for the user when wearing the glasses.</i> <i>Life span of the glasses may be prolonged due to greater resistance to potential damage.</i></p> <p>Incorrect/ no response</p> <p>Band 1</p> <ul style="list-style-type: none"> • The candidate has a simplistic knowledge of the issues associated with the question. • Limited use of terminology and technical language. • The candidate will list basic properties but not linked to the function of the frame. • Answers may deviate from the question or not be relevant. <p>Band 2</p> <ul style="list-style-type: none"> • The candidate has a basic understanding of the issues associated with the question. • Satisfactory use of terminology and technical language. • The candidate has some general knowledge of the qualities and properties of the smart material and but makes little reference to the frames function. • The candidate will express straightforward ideas clearly. Answers may deviate from the question or be weakly presented. <p>Band 3</p> <ul style="list-style-type: none"> • The candidate demonstrates a clear understanding of the issues associated with the question. • Good use of terminology and technical language. • The candidate has demonstrated real knowledge about the qualities and properties of the smart material in relation to the user and the function of the frame. • The candidate will express clearly and fluently. Answers will be generally relevant and structured. 			0 1 2-3 4-5

Question 3	Two types of earphones pictured below perform the same function.		
	AO3	AO4	Mark
Analyse the anthropometric considerations for both products shown.	✓		[8]
<p><i>The response must analyse appropriate anthropometric considerations/ data for the two types of head/ear phones. Based on:</i></p> <p>Headphone.</p> <ul style="list-style-type: none"> • <i>Head size, this is important in order that the headphones can reach over a user's head comfortably.</i> • <i>The headphones can be adjusted to suit different head sizes.</i> • <i>Ear size, this will be important as it will allow the headphones to sit comfortably over the user's ears.</i> • <i>Hand size to remove/adjust the headphones.</i> <p>Ear pods</p> <ul style="list-style-type: none"> • <i>Inner ear sizes, this will allow the ear buds to fit inside the ear comfortable for the length of time the user is using them.</i> • <i>Shape of inner ear</i> • <i>Hand size in relation to fingers holding/inserting the buds</i> <p>Candidates must discuss both products to achieve full marks.</p> <p>Incorrect/ no response</p> <p>Level 1</p> <ul style="list-style-type: none"> • The candidate has a simplistic/limited knowledge of the issues associated with the question. • Limited use of terminology and technical language. • The candidate has limited knowledge of the anthropometric considerations for the products. • Answers often deviate from the question or not be relevant. <p>Level 2</p> <ul style="list-style-type: none"> • The candidate has a basic understanding of the issues associated with the question. • Satisfactory use of terminology and technical language. • The candidate has some knowledge of the anthropometric considerations for the products and consideration for the user, but these are not always considered in detail. • Answers may deviate from the question. <p>Level 3</p> <ul style="list-style-type: none"> • The candidate demonstrates a clear understanding of the issues associated with the question. • Good use of terminology and technical language. • The candidate has demonstrated real knowledge of anthropometric considerations for the products and consideration for the user • There are descriptive comments about some elements of the needs of the end user. • Answers will be generally relevant, structured and linked to the question. 			
			0
			1-2
			3-4
			5-6

	<p>Level 4</p> <ul style="list-style-type: none"> • The candidate demonstrates a specific ability to analyse the products and has a clear understanding of the issues associated with the question. • Very good use of terminology and technical language. • The candidate has demonstrated detailed knowledge of anthropometric considerations for the products and consideration for the user. There are detailed descriptive comments about specific elements of the needs of the end user. • Answers will be consistently relevant and structured. <p>Example:</p> <p><i>Both type of earphones allow the individual to enjoy personal music, phone call etc. when moving or exercising, however, the designer will require the detailed knowledge/ understanding of different anthropometric information. Both designs will be based on anthropometric information for the 90th percentile because this is the generally accepted design range. The overhead ear phones are larger and heavier and require knowing the size of the head from ear to ear, in addition the designer will need to build in some adjustment to allow for the variation in head size. These headphones will also need to consider earlobe size for the same group, because they must be large enough to sit comfortably over the ears of the user and not sitting on the ear as this will become uncomfortable for the user. The earbud design is smaller and more convenient to use but requires detailed information regarding size and shape of the inner part of the earlobe, if the bud is too small it could become trapped in the user's ear, too large and it will not fit, in both situations it could become dislodged when the user is moving. The ear bud will require information regarding the hand/finger sizes because the user will need to carefully insert and remove them carefully from their ear and they will need some method of holding the bud.</i></p>	<p>7-8</p>
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Question 4	The aluminium case for a laptop computer is CNC milled from one piece of solid aluminium.		
	AO3	AO4	Mark
(a)	Describe the benefits to the manufacturer of using a CNC miller to make the aluminium case.		✓ [4]
<p><i>The response must refer to the benefits of CNC milling linked to the product.</i></p> <ul style="list-style-type: none"> • <i>Speed, the CNC miller will allow for a much faster production time.</i> • <i>Accuracy the CNC miller will be very accurate with each case.</i> • <i>Consistency, each case will be identical</i> • <i>High quality finish can be achieved</i> • <i>Cost, once set up the production cost for each individual unit will be low</i> <p><i>Incorrect/ no response</i> 0</p> <p><i>Benefit of using CNC</i> 1</p> <p><i>Description of the benefit of using CNC for the manufacturer.</i> 2</p> <p>Identification of benefit with no discussion maximum of 2 marks</p> <p>Example</p> <p><i>The manufacturer would use computer numeric control miller (CNC) to produce the computer case because the machine finish will be accurate.</i> 1</p> <p><i>The manufacturer would use computer numeric control miller (CNC) to produce the computer case because the machine finish will be accurate and of a high quality, this is essential because of the small size of all the components used in the Laptop and it has an expensive 'high quality' aesthetic.</i> 2</p> <p><i>The manufacturer would use computer numeric control miller (CNC) to produce the computer case because the machine finish will be accurate and of a high quality, this is essential because of the small size of all the components used in the Laptop and it has an expensive 'high quality' aesthetic. A CNC miller will also produce identical versions of the laptop.</i> 3</p> <p><i>The manufacturer would use computer numeric control miller (CNC) to produce the computer case because the machine finish will be accurate and of a high quality, this is essential because of the small size of all the components used in the Laptop and it has an expensive 'high quality' aesthetic. A CNC miller will also produce identical versions of the laptop, this will allow for high level of quality control and the use of standardised components in the laptop reducing manufacturers costs.</i> 4</p> <p>Accept any other appropriate response</p>			

	A03	A04	Mark
(b)	Justify the use of aluminium for the case.	✓	[4]
	<p><i>The response must justify the benefits of using aluminium.</i></p> <ul style="list-style-type: none"> • <i>Aluminium has an expensive 'high quality silver/white aesthetic'</i> • <i>Malleable and ductile easy to machine in an automated factory</i> • <i>High strength to weigh ratio, making the case very light weight</i> • <i>Corrosion resistant and will not require additional coating/protection.</i> • <i>Conducts heat - case serves as a heat sink.</i> • <i>Easily coated for protection.</i> 		
	<i>Incorrect/ no response</i>		0
	<i>Qualities of aluminium</i>		1
	<i>Justified benefit of using aluminium.</i>		2
	Identification of benefit with no justification maximum of 2 marks		
	Example		
	<i>Aluminium is a suitable material for the case because of its high strength to weight ratio.</i>		1
	<i>Aluminium is a suitable material for the case because of its high strength to weight ratio, it will protect the delicate internal components of the laptop while still being light enough for the user to carry.</i>		2
	<i>Aluminium is a suitable material for the case because of its high strength to weight ratio, it will protect the delicate internal components of the laptop while still being light enough for the user to carry. In addition, aluminium has an expensive, high quality aesthetic appearance.</i>		3
	<i>Aluminium is a suitable material for the case because of its high strength to weight ratio, it will protect the delicate internal components of the laptop while still being light enough for the user to carry. In addition, aluminium has an expensive, high quality aesthetic appearance that is currently on trend and this will appeal to many consumers.</i>		4
	Accept any other appropriate response		

	<p>Level 2</p> <ul style="list-style-type: none"> • The candidate has a basic understanding of the issues associated with the question. • Satisfactory use of terminology and technical language. • The candidate has some general knowledge of the benefits of recycling and environmental issues, but they are not always considered in detail. • The candidate will express straightforward ideas clearly, if not always fluently. Answers may deviate from the question or be weakly presented. • There may be some errors of grammar, punctuation and spelling but is still able to communicate the issues <p>Level 3</p> <ul style="list-style-type: none"> • The candidate demonstrates a clear understanding of the issues associated with the question. • Good use of terminology and technical language. • The candidate has demonstrated real knowledge about the environmental issues, linked to the products discussed. There are descriptive comments about recycling and the effect on the end user. • The candidate will express moderately complex ideas clearly and fluently, through well-linked sentences and paragraphs. Answers will be generally relevant and structured. • There may be occasional errors of grammar, punctuation and spelling. <p>Level 4</p> <ul style="list-style-type: none"> • The candidate demonstrates a specific ability to evaluate questions, considers a wide range of factors and has a clear understanding of the issues associated with the question. • Very good use of terminology and technical language. • The candidate has demonstrated detailed knowledge about the the environmental issues linked to the product identified. There are detailed descriptive comments about specific elements of the recycling and the impact on the end user. • The candidate will express complex ideas extremely fluently. Sentences and paragraphs will follow on from each other smoothly and logically. Answers will be consistently relevant and structured. • There will be few, if any, errors of grammar, punctuation and spelling. <p><i>Accept any other appropriate response</i></p>	<p>3-4</p> <p>5-6</p> <p>7-8</p>
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Question 6		Drinks can easily be spilt in many different locations both indoors and outdoors.		
		AO3	AO4	Mark
(a)	<p>Design Brief You are asked to design a product that will securely hold a drinking cup like the one below which will prevent spillage of liquid. The product must attach to the edge of a table or desk.</p> <p>Specification Your design proposal must:</p> <ul style="list-style-type: none"> • Securely attach to any fixed surface up to 40mm in thickness • Hold a container up to 75mm in diameter • Be easily attached and removed with one hand • Be strong and lightweight for ease of transportation • Include appropriately named materials <p><i>You are required to use a mixture of 2D and 3D annotated freehand drawings.</i></p> <p>Marks will be awarded for:</p>		✓	
(i)	<p>An innovative functioning product that meets the design brief and specification.</p> <p><i>The response must contain an innovative design for a cup holder</i></p> <p><i>Incorrect/ no response.</i></p> <p><i>Design produced showing no creative features.</i></p> <p><i>Design produced with limited creative features, some not relevant to the design problem.</i></p> <p><i>Design proposed with creative features, clearly relevant to the design problem.</i></p>			<p>[6]</p> <p>0</p> <p>1-2</p> <p>3-4</p> <p>5-6</p>

(ii)	<p>Annotating your product to show how it can be easily attached, removed, hold the cup securely and be transportable.</p> <p><i>The response must contain a possible design for a cup holder You are required to use a combination of 2D and 3D freehand drawings. Together with evidence of consideration of user interface, function and style.</i></p> <p><i>Incorrect/ no response</i></p> <p>Design that has very little detail and no reference to the issues in the specification.</p> <p>Design that lacks detail but has some reference to the issues in the specification.</p> <p>Design idea developed with some supporting annotation that is relevant and links the proposal to some of the issues in the specification.</p> <p>Design idea developed with supporting annotation that is relevant to the design and indicates a clear understanding of the specification.</p> <p>Innovative ideas developed with supporting annotation is relevant to the design user interface, form, details and materials which demonstrates a detailed understanding, and displays clear links to all the specification.</p>	<p>[10]</p> <p>0</p> <p>1-2</p> <p>3-4</p> <p>5-6</p> <p>7-8</p> <p>9-10</p>
(iii)	<p>Justification of two appropriately named materials.</p> <p><i>The response must identify and justify appropriate materials that can be used to make the holder.</i></p> <p>Guidance to markers</p> <p><i>No mention of material.</i></p> <p><i>Identifying material.</i></p> <p><i>Justifying the use of the selected material.</i></p> <p><i>Maximum 2 marks if the generic term Plastic/Polymer is used.</i></p> <p>Maximum 4 marks</p> <p><i>Examples:</i></p> <ul style="list-style-type: none"> • <i>Polypropylene, Polyurethane, Polycarbonate</i> • <i>The above can be easily shaped is very lightweight case that will withstand an impact.</i> • <i>Easy to process on a large/ industrial scale.</i> • <i>Can be produced in a range of colours allowing for individuality.</i> • <i>Spring steel</i> <p>Accept any other appropriate response</p>	<p>[4]</p> <p>0</p> <p>1</p> <p>1</p>

(iv)	<p>The quality/presentation and communication of your 2D/3D drawings. <i>There MUST be a mixture of 2D and 3D design sketches generated. Sketches should include annotation.</i></p> <p><i>Candidates are not expected to render, colour or shade your design work.</i></p> <p>Guidance to markers</p> <p>The emphasis is on the quality of communication and presentation of design ideas.</p> <p><i>No response worthy of a credit.</i></p> <p>Idea developed with either 2D or 3D illustrations only.</p> <p>Idea developed with both 2D and 3D illustrations, illustrations provide limited information.</p> <p>Ideas developed with both 2D and 3D illustrations, illustrations highlight many design details for the design.</p> <p>Skilled use of both 2D and 3D illustrations, illustrations demonstrate all details fully explain the design.</p>	<p>[4]</p> <p>0</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p>
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	AO3	AO4	Mark
(b)		✓	[8]

There **MUST** be a 2D or 3D drawing. The drawing must provide the details and information required to construct the proposed design.

Guidance to markers

The emphasis is on the quality, clarity and communication of all the required details and information.

No response worthy of a credit.

0

Design shown as 2D or 3D illustration, no additional information.

1-2

Design presented as 2D or 3D drawing. Drawing provides limited information and do not comply with BS standards.

3-4

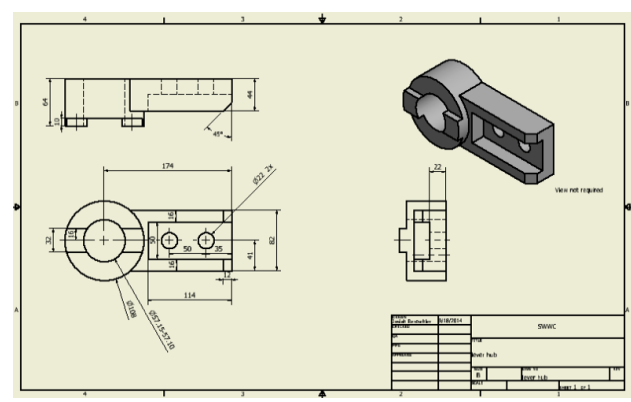
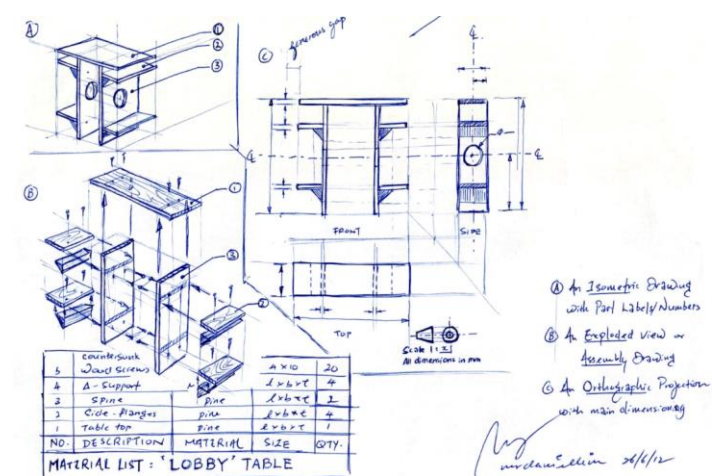
Design presented as 2D or 3D drawing. Drawing provides information sufficient for the manufacture of the design.

5-6

Skilled presentation of 2D or 3D drawing. Drawing demonstrates all details fully explain the design and complies with British Standards

7-8

Examples



		A03	A04	Mark
(c)	Modelling and testing of ideas are an essential part of the iterative design process.		✓	
(i)	Discuss the benefits of modelling and testing ideas in the development a product.			[4]
	<p><i>The response must discuss the importance of modelling and testing ideas during the development of a product.</i></p> <p><i>Response could refer to:</i></p> <ul style="list-style-type: none"> • 3D models, card, Stryo-foam, clay, ploy morph, balsa etc. • Quick idea testing. • CAD modelling and testing. • Exploration of forms and shapes. • Material testing. • Early identification of any problems or issues with design proposals • Potentially reduce manufacturing costs <p>Guidance to markers</p> <p><i>Incorrect/ no response</i> 0</p> <p><i>Identification of a benefit, no discussion</i> 1</p> <p><i>Identification of a benefit, with discussion</i> 2</p> <p>Identification of benefit with no discussion maximum of 2 marks</p> <p>Example:</p> <p><i>A model 3D could be made using stryo-foam or other similar materials to show the shape of the product.</i> 1</p> <p><i>Use of 3D stryo-foam models, these will allow the designer to study/review the aesthetic forms of the product market and make suitable adjustments.</i> 2</p> <p><i>Use of 3D stryo-foam models, these will allow the designer to study/review the aesthetic and ergonomic forms of the product. The model could then be made in a range of different potential materials to test their suitability.</i> 3</p> <p><i>Use of 3D stryo-foam models, these will allow the designer to study/review the aesthetic and ergonomic forms of the product. The model could then be made in a range of different potential materials to test their suitability.</i> 4</p> <p><i>CAD models, these will allow the designer to run simulations and destruction test the design without having to manufacture a large number of physical models, this will save time, money and materials.</i></p> <p>Accept any other appropriate response</p>			

