GCE AS MARKING SCHEME

SUMMER 2024

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

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.

GCE DESIGN & TECHNOLOGY

PRODUCT DESIGN - UNIT 1

SUMMER 2024 MARK SCHEME

Q1.	JIGs are commonly used in the manufacture of products like the clothing rail shown below.			
		AO3	**AO4**	**Mark**
(a)	Describe the meaning of the term 'jig' and explain the benefits to the manufacturer of using a range of jigs in a production run.		✓	4
	The response must give a description of a jig, its function and fully explain appropriate benefits of using a jig: **Guidance to markers** Accept any **two** justified benefits *Incorrect/No answer.* 0 *Identification of benefit.* 1 *Identification and justification of benefit.* 2 **Example** A jig is a piece of equipment that is attached to a material guiding a tool or holding a tool in place. *The response must name appropriate benefits of using a jig: 1 Mark for each suitable response with a justification.* Response could refer to: • holding the material in place while guiding the tool/equipment. • Improved consistency, all joints will be of the same quality. • Improved accuracy, all joints will be identical. • Improved speed, time is saved due to reduced setting up times. • Improved productivity, time saved due to reduced setting up times Lower skill level of operative, the operator will only be required to use equipment using simple operations. **Examples** A jig is used because it is quicker. 1 A jig would be used because it will be quicker and produce greater consistency. **Or** Using a jig will be quicker because the joints and holes do not need to be marked every time. 2 **Or** A jig would be used because it will increase the speed of production due to the fact that you are combining the marking out and drilling process. 2			

(b)	Select a part of the clothing rail. Using annotated sketches, design a jig that could be used for manufacturing the part .		✓	4

The response must provide an annotated sketch of a simple JIG for a specific task:

Guidance to markers.
Accept any **two** justified benefits

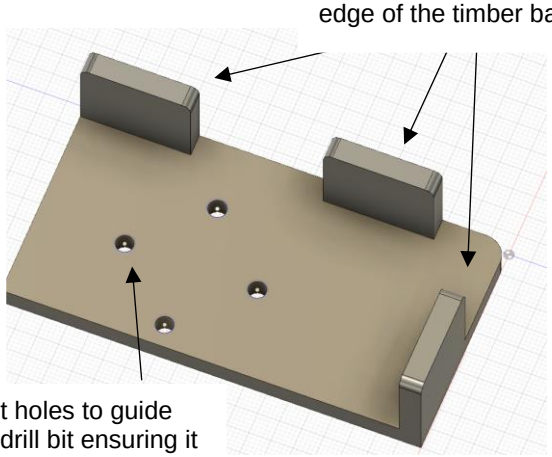
Incorrect/No answer.	0
Simple sketch. No annotation	1
Simple sketch which clearly identifies the task parts simply labelled.	2
Simple sketch which identifies the task and key elements of the jig and have one or two supported annotated notes.	3
Clear sketch which identifies the task and key elements of the jig and have detailed supported annotated notes.	4

Example

This jig will be used to drill location holes for the main pole to the timber base of the rail

Tags/Lugs to be place on the edge of the timber base.

The simple jig can be clamped to the timber base using a G clamp or Quick release clamps. The operator can then drill the pilot hole using an electric drill and suitable bit



Pilot holes to guide the drill bit ensuring it is in the correct place and consistent.

Q2.	The car body below is manufactured from an aluminium alloy.			
		AO3	AO4	Mark
(a)	Explain the meaning of the term ‘alloy’.		✓	2
	The response must give a description of the term ‘Alloy’: 1 Mark for each suitable response. Response could refer to: • A metal compound combining of two primary metals. • The primary metals cannot be identified in the alloy. • Alloys have altered properties. • Alloys have improved properties. **Guidance to markers.** 1 mark for each description. *Incorrect/No answer.* *Description of Alloy.* **Example** The term alloy is applied to a metal that is formed by combining two other metals. The term alloy is applied to a metal that is formed by combining two other metals or elements. The alloy will have improved properties when compared with the original metals. ***Accept any other appropriate response*** ***Max 2 marks***			0 1 1 2

(b)	Explain the benefits for the manufacturer and consumer of using an aluminium alloy for the car body.		✓	6

The response must explain benefits of aluminium alloy that relate to both the manufacturer and the consumer

Response could refer to:

- The malleability of aluminium.
- Better fuel economy because of lighter body shell.
- Improved performance of the vehicle because of the lighter body shell.
- Improved resistance to corrosion of aluminium.
- Lower environmental impact in the production of aluminium.

Guidance to markers.
1 mark for each description.

Incorrect/No answer.	0
Statement of benefit.	1
*Statement of benefit with explanation**.***	2
Example	
Aluminium is a malleable material.	1
Aluminium is a malleable material, and this allows the manufacturer to produce shaped/formed panels quickly.	2
Aluminium is a malleable material, and this allows the manufacturer to produce shaped/formed panels quickly. Aluminium cars are lighter than steel cars.	3
Aluminium is a malleable material, and this allows the manufacturer to produce shaped/formed panels quickly. Aluminium cars are lighter than steel cars. This benefits the consumer because the fuel economy of the car will be better, and the car will cost less to run.	4
Aluminium is a malleable material, and this allows the manufacturer to produce shaped/formed panels quickly. Aluminium cars are lighter than steel cars. This benefits the consumer because the fuel economy of the car will be better, and the car will cost less to run. The lighter weight will also make the car easier to control when driving.	5
Aluminium is a malleable material, and this allows the manufacturer to produce shaped/formed panels quickly. The resistance to corrosion of aluminium will improve the life span of the structural elements and panels of the car. Aluminium cars are lighter than steel cars. This benefits the consumer because the fuel economy of the car will be better, and the car will cost less to run. The lighter weight will also make the car easier to control when driving.	6

A list of benefits with no justification Max 3 marks
Accept any other appropriate response
Max 6 marks

Q3.	Ergonomics is an essential consideration in the design of road crossings like the one shown below.			
		AO3	AO4	Mark
	Explain how ergonomic principles have been considered in the design of the:		✓	8
(i)	Pathway *The response must identify relevant path design features and link them with the ergonomic requirements of potential users.* Response could refer to: • Slope between road surface and pavement to allow for wheelchairs • Textured surface close to the junction of the road and pavement, allowing partially sighted users to identify the edge of the pedestrian area. • Contrasting colour allows for clear identification of 'safe' area for partially sighted users • Colour and texture define the approach and standing areas for pedestrians. **Guidance to markers.** 1 mark for each explanation. *Incorrect/No answer.* 0 *Identification of an ergonomic element.* 1 *Identification of an ergonomic element linked to user.* 2 **Examples** Paving slabs are a different colour and texture. 1 Paving slabs are a different colour and texture making it easy for partially sighted users to identify the safe parts of the crossing. 2 Paving slabs are a different colour and texture making it easy for partially sighted users to identify the safe parts of the crossing. The Pathway slopes towards the edge of the road. 3 Paving slabs are a different colour and texture making it easy for partially sighted users to identify the safe parts of the crossing. The Pathway slopes towards the edge of the road this will allow all users to cross the road easily and safely without tripping or wheels in pushchairs/wheelchairs getting stuck. 4 ***Accept any other appropriate response*** ***Max 4 Marks***			

(ii)	Button control unit *The response must identify relevant design features and link them with the ergonomic requirements of potential users.* Response could refer to: • Control panel/button at a height that is easily accessible to all users. • Red and Green symbols to indicate safe crossing. • Different characters for walking and stationary person, allowing users with colour blindness to identify safe crossing. • Red and green illuminated characters facing pedestrians, informing then when it is safe to cross. • Simple large button to press that activates the crossing. **Guidance to markers.** 1 mark for each explanation.	
	Incorrect/No answer.	0
	Identification of an ergonomic element.	1
	Identification of an ergonomic element linked to user.	2
	Examples	
	The control panel/button is placed at a suitable height.	1
	The control panel/button is placed at a height that makes it easy to use for both able-bodied and wheelchair users.	2
	The control panel/button is placed at a height that makes it easy to use for both able-bodied and wheelchair users. The control panel has clear illuminated images.	3
	The control panel/ button is placed on a clearly identified yellow box which will be easy for partially sighted pedestrians to identify. The panel is at a height that is easily accessible for both wheelchair and walking pedestrians to use easily. The control panel uses clear simple illuminated images that identify when it is safe to cross or when the pedestrian must wait.	4
	Accept any other appropriate response ***Max 4 Marks***	

Q4.	The environmental footprint is a critical consideration when packaging products.			
		AO3	**AO4**	**Mark**
	Describe how the material used in the products pictured contribute to their environmental footprint.		✓	8

Response could refer to:

- The environmental impact a product has through the manufacturing process.
- The environmental impact of the selected materials.
- The environmental impact of disposal of a product.
- Energy required to process/produce the materials
- Comparing the processing of the materials used steel in the tin can and the polymer used in the snap pot.
- Impact of polymer materials in the oceans.
- Possible re-use of the packages.
- Possible recycling of packaging materials.
- In both cases the containers are heavily processed materials that would require a lot of energy.
- The range of polymers used in food packaging often makes them difficult to recycle efficiently.
- Impact of the additional packaging for consumer information.

Guidance to markers.

Level 1 — **1-2**

- The candidate has a simplistic knowledge of the issues associated with the question.
- Limited use of terminology and suitable language.
- The candidate has limited knowledge of a product and environmental issues.
- The candidate will express basic ideas clearly, if not always fluently.
- Answers may deviate from the question or not be relevant.

Level 2 — **3-4**

- The candidate has a basic understanding of the issues associated with the question.
- Satisfactory use of terminology and suitable language.
- The candidate has limited knowledge of a product and environmental issues.
- Products are not described in appropriate detail.
- The candidate will express straightforward ideas clearly, if not always fluently. Answers may deviate from the question or be weakly presented.

Level 3 — **5-6**

- The candidate demonstrates a clear understanding of the issues associated with the question.
- Good use of terminology and suitable language.
- The candidate has sound knowledge of a products and the environmental impact.
- Products are described with some details.
- The candidate will express moderately complex ideas clearly and fluently, through well-linked sentences and paragraphs. Answers will be generally relevant and structured.

	Level 4 • The candidate demonstrates the ability to analyse the question and considers a range of factors. • The candidate demonstrates a clear understanding of the issues associated with the question. • Very good use of terminology and technical language. • The candidate has good knowledge of a product and environmental issues associated with it. • Products are described in appropriate detail. • 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. ***Accept any other appropriate response*** ***Max 8 Marks***	**7-8**

Q5.	It could be argued that “Creativity + Iterative Development = Innovation.”			
		AO3	**AO4**	**Mark**
	Evaluate the contribution that creativity and iterative development have on innovative and successful products. Marks will be awarded for the content of the answer and the quality of written communication.	✓		8

Response could refer to:

- How different versions of a product have developed over a period of time.
- How a product has been developed by a company/designer prior to its launch.
- How the iterative process has been applied by a company/designer.
- Use of CAD/CAM in the iterative process.
- Products being tested i.e. New model cars being driven on public roads prior to launch.
- Iterations during a products lifetime i.e. the development of mobile phones, Sony Walkman
- Trialling and testing of a product, IKEAs use of test rigs for the Poang chair.
- Use of traditional modelling techniques to test ideas.
- Innovative developments of a product.

Guidance to markers.

Incorrect/ no response — **0**

Level 1 — **1-2**

- The candidate has a simplistic knowledge of the issues associated with the question.
- Limited use of terminology and technical language.
- The candidate has limited knowledge of a product and/or no understanding of the iterative design process.
- The candidate will express basic ideas clearly, if not always fluently.
- Answers may deviate from the question or not be relevant.
- Grammar, punctuation and spelling may be weak impacting on effective communication.

Level 2 — **3-4**

- The candidate has a basic understanding of the issues associated with the question.
- Satisfactory use of terminology and technical language.
- The candidate has limited knowledge of a product and understanding of the iterative design process.
- Products are not 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

	Level 3 • The candidate demonstrates a clear understanding of the issues associated with the question. • Good use of terminology and technical language. • The candidate has sound knowledge of a product and understanding of the iterative design process. • Product is considered with some details identified. • 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. **Level 4** • The candidate demonstrates a specific ability to analyse 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 good knowledge of a product and understanding of the iterative design process. • Product is considered with many details identified. • 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. ***Accept any other appropriate response***	**5-6** **7-8**

Q6				
		AO3	AO4	Mark
(a)	Design a prototype space saving collapsible stool for a young child. The space saving collapsible stool is to be manufactured in plywood using a CNC machine.		✓	16
	Specification The design of the stool must: • be a creative design that would appeal to a 3 to 5-year-old child • have a seat height of 300mm • be easily assembled and dis-assembled • make innovative use of plywood sheet • be safe and stable • be portable and lightweight. ***You are required to use a mixture of 2D and 3D freehand drawings.*** Marks will be awarded for:			
(i)	An innovative design that meets the specification above. *The response must contain possible innovations based on the material*			
	Incorrect/ no response.			0
	Design produced showing no innovative features.			1
	Design produced with limited innovative features, some not relevant to the specification.			2
	Design produced with limited innovative features, some not relevant to the specification and the use of plywood sheet.			3
	Design proposed with innovative features, most relevant to the specification and the use of plywood sheet.			4
	Design proposed with innovative features, most relevant to the specification and identified as relevant and the use of plywood sheet.			5
	Innovative design features clearly relevant to the design specification and all identified as relevant to the and the use of plywood sheet.			6
	Max 6 marks			
(ii)	*Clear constructional details.* *The response must contain possible innovations based on the material*			
	Incorrect/ no response.			0
	Design produced with few details many of which are not suitable for plywood or able to be easily assembled and dis-assembled			1
	Design produced with details some of which are not suitable for plywood or able to be easily assembled and dis-assembled.			2
	Design proposed with suitable constructional details appropriate to the use of a plywood sheet and easy assembly and dis-assembly but with no explanation.			3
	Design proposed with suitable constructional details appropriate to the use of a plywood sheet and explanation of assembly and dis-assembly process			4
	Maximum 4 marks			

(iii)	*The inclusion of appropriate dimensions.* *The response must contain appropriate dimensions for a stool.* *Incorrect/ no response.* *Design produced with few dimensions many of which are not relevant or inappropriate.* *Design produced with suitable dimensions many of which are relevant for the stool and the user group.*	 0 1 2
(iv)	*The quality/presentation and communication of your 2D/3D drawings.* *The response must contain a possible design for a stool.* *There MUST be a mixture of 2D and 3D design sketches generated. Sketches should include annotation.* ***Candidates are not expected to render, colour or shade your design work.*** **Guidance to markers** The emphasis is on the quality of communication and presentation of design ideas. *Incorrect/ no response* 2D images that have very little detail and no supporting notes. Idea developed with simple 2D and 3D drawings some supporting annotation. Ideas developed using both 2D and 3D drawings with supporting annotation that is relevant to the task and indicates understanding of the design. Ideas developed using high quality and clearly presented 2D and 3D drawings with supporting annotation that is relevant to the task and indicates a clear understanding and links to the design. ***Max 4 marks***	 0 1 2 3 4

		AO3	AO4	Mark
(b)	Discuss the manufacturing considerations needed to successfully produce the space saving collapsible stool using a CNC machine.		✓	4

The response must identify and discuss the manufacturing issues involved with the use of CNC

Response could refer to:

- Efficiency with which the design can be produced.
- Variety of Stool designs to be made.
- Ability to modify the product quickly using CNC
- Number of stools to be made vs Cost of setting up a CNC production line.
- Training of operators to use the CNC.
- Discuss the use of a jig's vs CNC.
- Energy costs to run the machines.Material size / thickeness
- Tooling of the machine

Guidance to markers.
1 mark for each explanation.

Incorrect/No answer.	0
Identification of CNC issues.	1
*Identification and discussion of each CNC***.**	2
Example	
Using the same CNC manufacturing machine will allow the stool to be manufactured quickly.	1
Using the same CNC manufacturing machine will allow the stool to be manufactured quickly saving time which will reduce the cost of the final product.	2
Using the same CNC manufacturing machine will be costly to install but will allow the stool to be manufactured quickly and with greater consistency improving quality control and customer satisfaction.	3
Using the same CNC manufacturing machine will be costly to install but will allow the stool to be manufactured quickly and with greater consistency improving quality control. A CNC system will allow for rapid modifications of the stool design without the need to produce expensive new jigs.	4

4 identified uses with no justification max 2 marks.
Accept any other appropriate response

		AO3	AO4	Mark
(c)	Justify how your space saving collapsible stool could be appropriately finished.		✓	4

The response must justify the use an appropriate finish and how it will benefit the stool.

Response could refer to:

Finishes:
- Varnish.
- Paints
- Wax oils
- Danish oil

Justification:
- Protecting the material used in the construction of the stool.
- Enhancing the appearance of the stool.
- Allowing for ease of cleaning of the stool.
- Allowing the application of bright colours.

Guidance to markers.
1 mark for each explanation.

Incorrect/No answer.	0
Identification of suitable finish.	1
*Each Justification for selection***.**	1
Example	
Polyurethane Varnish.	1
Polyurethane varnish will be used as it provides a tough surface coating.	2
Polyurethane varnish will be used as it provides a tough, waterproof surface coating, this would be important in the domestic environment preventing surface damage when the stools are being collapsed or moved.	3
Polyurethane varnish will be used as it provides a tough waterproof surface coating and can be applied over a stain or dye. This would be important in the domestic environment preventing surface damage when the stools are collapsed or moved.	4

Response referring only to; stains, Polishes, Oils and External Preservatives Max 2 Marks.
Accept any other appropriate response
Maximum 4 marks

		AO3	AO4	Mark
(d)	The space saving collapsible stool is to be manufactured and sold in the UK. Analyse the impact of this decision.	✓		8

The response must identify and refer to the effects of manufacturing with reference to the UK and.

Response could refer to:

- Availability of local skilled workforce.
- Availability of reliable power supplies.
- Availability of 'Clean power' supplies.
- Impact on developing economies
- Impact on CO2 emissions through transport.
- Suitability of reliable transport links.
- Location of product market.
- Location of necessary raw materials.
- Cost of shipping.
- Working conditions for manufacturing employees, national regulations/ safety guidance and this impact on cost.
- Impact on cost of final product.
- Potential marketing strategies.
- British Standards / safety standards / Lion Mark

Guidance to markers.

Incorrect/ no response **0**

Level 1

- The candidate has a simplistic knowledge of the issues associated with the question.
- Limited use of terminology and technical language.
- The candidate has limited knowledge of the impact of manufacturing the product in different geographic locations.
- The candidate will express basic ideas clearly, if not always fluently. Answers may deviate from the question or not be relevant.

1-2

Level 2

- 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 impact of manufacturing the product in different geographic locations 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.

3-4

Level 3

- The candidate demonstrates a clear understanding of the issues associated with the question.
- Good use of terminology and technical language.
- The candidate has demonstrated sound knowledge of the impact of manufacturing the product in different geographic locations. These ideas are linked to the context of the product.
- The candidate will express moderately complex ideas clearly and fluently, through well-linked sentences and paragraphs. Answers will be generally relevant and structured.

5-6

	Level 4 • The candidate demonstrates a specific ability to analyse 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 of the impact of manufacturing the product in different geographic locations. These ideas are linked to the context of the product • 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. ***Accept any other appropriate response*** ***Maximum 8 marks***	**7-8**

		AO3	AO4	Mark
(e)	Discuss:		✓	8
(i)	The benefits of user centred designing for the extension of the range of stools to an adult market. *The response must show /identify/ demonstrate the candidates understanding of the benefits when using a user centred design approach .* Response could refer to: • Putting the user at the centre of design development. • Identification of people who will use the product. • Writing detailed, focused specifications. • Identify requirements of adult users that must be met for the product to be successful. • Developing a successful product by testing on a focussed group, iterative development of a product. • Producing a stool suitable for a specific adult market. • Identification of specific measurable information data i.e. anthropometric data. 1 mark for each explanation. *Incorrect/No answer.* *Identification of suitable benefit.* *Justification for selection*. **Guidance to markers.** *Incorrect/ no response* A benefit of user centred design is putting the user at the centre of the design development process. User centred design requires the identification of the specific users and putting them at the centre of the design process and will develop products that are relevant and appropriate for them. User centred design requires the identification of the specific users and putting them at the centre of the design process, focusing on specific users will allow for the identification of their specific requirements developing products that are relevant and appropriate for them. User centred design approach requires the identification of the specific users and putting them at the centre of the design process, focusing on specific users will allow for the identification of their specific requirements developing products that are relevant and appropriate for the use through constant referral to specific user trials and tests. ***Accept any other appropriate response***			[4] 0 1 1 0 1 2 3 4

(ii)	How creative thinking strategies could be employed when extending the range of stools into the adult market. *The response must show /identify/ demonstrate the candidates understanding of the benefits when using creative thinking strategies* Response could refer to designing strategies such as: • Inversion • Morphological analysis • Analogy • Lateral thinking • Six thinking hats • Mind mapping • Mood boards • Product disassembly / reverse engineering 1 mark for each explanation. *Incorrect/No answer.* *Identification of suitable benefit.* *Justification for selection***.** **Guidance to markers.** *Incorrect/ no response* Creative thinking strategies could be used to develop a wider range stools that would be suitable for the adult market. Creative thinking strategies such as lateral thinking, mind mapping could be used to develop a wider range stools that would be suitable for the adult market. Creative thinking strategies such as lateral thinking, could be used to develop a wider range of stools**.** Employing this approach means that the designer will look at the problem from a different viewpoint or perspective which will allow the development of a range of stools. Creative thinking strategies such as lateral thinking, could be used to develop a wider range of stools**.** Employing this approach means that the designer will look at the problem from a different viewpoint or perspective i.e. What is not needed in the design of a child's stool? This approach will allow the designer to disregard any of the elements that are suitable to only a child's stool. ***Accept any other appropriate response***	[4] 0 1 1 0 1 2 3 4