GCE AS MARKING SCHEME

SUMMER 2022

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

INTRODUCTION

This marking scheme was used by WJEC for the 2022 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

PRODUCT DESIGN - UNIT 1

SUMMER 2022 MARK SCHEME

<table>
<tr><td>Question1</td><td colspan="3">The photographs below show four different uses of mild steel.</td></tr>
<tr><td></td><td></td><td>AO3</td><td>AO4</td><td>Mark</td></tr>
<tr><td>(a)</td><td>State the physical properties of mild steel that make it suitable for the uses shown above.</td><td></td><td>✓</td><td>2</td></tr>
<tr><td></td><td colspan="3">The response must identify the relevant physical properties of mild steel

Incorrect/ no response

1 mark for each reason. (Maximum 2 marks for the question)

Examples:

The physical properties of mild steel include:
• strength
• ductility
• hardness
• impact resistance
• toughness
• Malleability when heated

Guidance to markers
Incorrect/ no response
Mild steel is a ductile material that can be drawn into a range of shapes.
Mild steel is both ductile and tough, these properties allow the material to be drawn into a range of shapes/ forms and absorb many impacts without damage.
Accept any appropriate relevant answer.</td><td>0 marks
1 mark
2 marks</td></tr>
</table>

		AO3	AO4	Mark
(b)	The steel frame in parts of the building and the trailer has been galvanized. Give a detailed reason for this surface finish.		✓	**2**
	Award up to 3 marks based on: *Galvanising* • *Provides protection from the environment.* • *Hard wearing and long lasting and is suitable for external conditions.* • *Protects the mild steel from corrosion.* • *Will need less maintenance to maintain the integrity of the mild steel.* • *Less ongoing maintenance* • *Expensive to apply using specialist facilities* **Guidance to markers** Incorrect/ no response Galvanising provides protection from the environment. A galvanised finish is hard wearing and will last for a long time providing the mild steel with protection from corrosion in any environment. Accept any appropriate relevant answer.			**0 marks** **1 mark** **2 marks**

		AO3	AO4	Mark
(c)	Using notes and sketches describe a method of permanently joining mild steel to mild steel.		✓	**4**

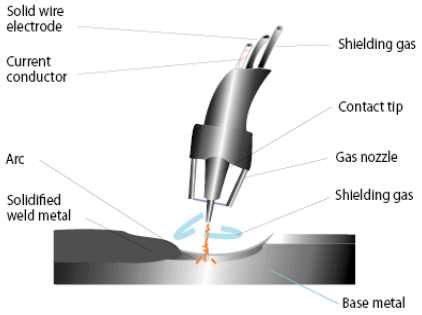
Award up to 4 marks based on:

Identification of one method of joining mild steel i.e., Brazing/Gas welding, Spot, MiG, TiG, Electrode/Arc welding.

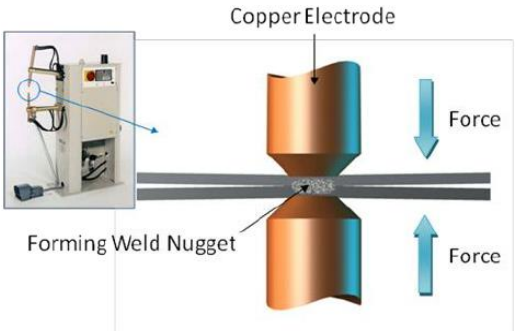
- *Using rivots*
- *Use of a labelled diagram explaining the elements of the selected welding method.*
- *Statement identifying that heat is required to melt the parent metal; heat source can be either gas or electrical.*

Accept soldering as a permanent method of joining metals but limit to ½ marks as this is not fully appropriate / suitable in the context of the question

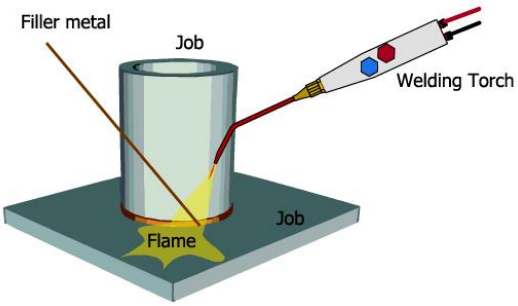
ELECTRODE/ARC

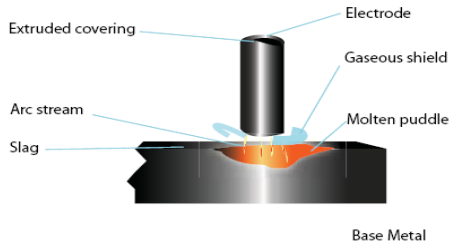
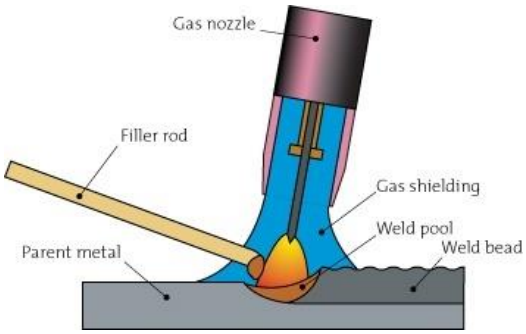


SPOT WELDING



BRAZING/GAS WELDING



	MIG WELDING  TIG WELDING  	
	Poor quality sketch that does not show process.	**0 marks**
	Quality sketch that shows the process.	**1 mark**
	Guidance to markers	
	Incorrect/ no response	**0 marks**
	A simple diagram with limited understanding – limited labelling.	**1 mark**
	A more detailed diagram demonstrating understanding – All key parts labelled.	**2 marks**
	A detailed diagram supported with labels and a written explanation demonstrating understanding of the welding method identified.	**3 marks**

Question 2	Product designers and manufactures have access to materials that are produced in 'stock size/form.			
		AO3	AO4	Mark
(a)	Explain the term 'stock size/form		✓	2
	The response must demonstrate understanding of the term 'stock size/ form. *Example:* Incorrect/ no response Materials that have been machined / processed into standard sizes, shapes or forms. Materials that are kept in specified forms/sizes by material suppliers ready for immediate dispatch when ordered. **Accept any other appropriate response**			**0 marks** **1 mark** **2 marks**

		AO3	AO4	Mark
(b)	Justify the advantages to both the designer and manufacturer of materials being available in 'stock form'.		✓	**6**

The response must be justifying the advantages of stock size/ form material.

Award up to 6 marks based on:

- *Uniformity of size of materials across countries, allows sourcing of material from the cheaper supplier even if that is another country.*
- *Ease of transport / handling once converted from raw material: stock sizes allow for specialised handling equipment that can load/ unload quickly, stackable and palletised.*
- *Stock sizes are cheaper than specialised sizes.*
- *QC is guaranteed by the manufacturer of the stock form.*
- *Consistent appearance/ finish, designer or manufacturer can be assured of the aesthetic qualities of the material.*
- *Standard sizes allows the designer work with the sizes of the stock forms to minimise waste/cost effective.*
- *Manufactures have access to stock piled materials reduce lead times.*

Incorrect/ no response	**0 marks**
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 stock materials.	**1 mark**
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 stock materials, but lacking detail.	**2-3 marks**
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 real knowledge and understanding of the suitability/importance/ use of stock forms.	**4-5 marks**
Level 4 • The candidate demonstrates a detailed understanding of the issues involved in the question. • Very good use of terminology and technical language. • The candidate has demonstrated detailed knowledge of the use and application of stock forms/materials in design and manufacture	**6 marks**

Question 3	**Reverse engineering and product analysis are two design strategies used within the iterative design process.** **Analyse the importance of both strategies in the design and development of a product.**			
		AO3	**AO4**	**Mark**
		✓		**8**

Award up to 8 marks for responses based on:

Examples:

Reverse Engineering

- *Can identify possible methods of manufacture.*
- *Can identify a possible range of materials which could be used.*
- *Can identify the assembly sequence.*
- *Requires a similar/same competitors' product. – for comparisons*
- *Understanding the technology used within a product and apply it in the design of the new product.*

Product Analysis

- *Can identify possible methods of manufacture.*
- *Can identify a possible range of materials which could be used.*
- *Can identify ergonomic considerations.*
- *Can identify anthropometric considerations.*
- *Can identify the products place in the market.*
- *Requires a similar/same competitors' product.*
- *Reference to user requirements.*
- *Costs/economics*

Do not credit answers that are repeated.

Responses must be based on Reverse Engineering and Product Analysis

Incorrect/ no response	**0 marks**
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 design strategies • The candidate will express basic principles clearly, if not always fluently.	**1-2 marks**
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 design strategies, but they are not always considered in detail. • The candidate will express straightforward principles clearly, if not always fluently. Answers may deviate from the question.	**3-4 marks**

	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 real knowledge and understanding of the research strategies • The candidate will express the application of the strategies clearly and fluently. **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 use and application of the two design strategies • The candidate will express complex ideas extremely fluently.	**5-6 marks** **7-8 marks**

Question 4	**Environmental issues are a world-wide concern. Study the images below and evaluate the advantages and disadvantages when using polymers in product design.**			
		AO3	**AO4**	**Mark**
		✓		**8**
	The response must discuss the use of designed polymers and identify both the advantages and disadvantages. *Responses could include:* *Use of oil in production.* *Disposal of waste polymers.* *Pollution of the oceans and the food chain.* *Use for a wide variety of products.* *Flexibility of the material i.e. range of colours and functions.* *Allowing for greater creativity in design.* *Manufacturing processes.* *Packaging.* *Reusing polymers.* *Incorrect/ no response*			**0 marks**
	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 aesthetic qualities of the product and/ or consideration for the user in their design. • 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.			**1-2 marks**
	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 aesthetic qualities and consideration for the user in the design aspects, 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			**3-4 marks**

	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 real knowledge about the aesthetic qualities, linked to the products discussed. There are descriptive comments about some elements of the needs of 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. **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 about the aesthetic qualities, linked to the products identified. There are detailed descriptive comments about specific elements of the needs of 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. ***Accept any other appropriate response***	**5-6 marks** **7-8 marks**

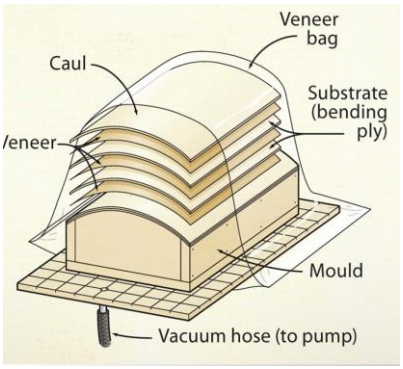
Question 5	The storage unit below is manufactured from a regenerated material, plywood. The unit consists of three parts that are slotted together.			
		AO3	AO4	Mark
(a)	Identify with reasons a possible method of manufacture for the end piece.		✓	**2**
	The response must identify possible method of manufacture for the end piece only with an appropriate reason • *CAM using a router or laser* • *Traditional hand cutting* • *Using a Jig or Template.* *Incorrect/ no response* **0 marks** Process stated with no justification. **1 mark** Process stated with supporting/ justified benefit. **2 marks** ***Stating two methods of manufacture with no justification award only 1 mark*** *Example:* **2 marks** *A CAM router. This will allow for a much faster production time when compared to making the product using traditional workshop tools.* ***Accept any other appropriate response*** ***Maximum 2 marks***			

		AO3	AO4	Mark
(b)	Using notes and sketches explain how the body of the unit could be formed.		✓	**4**

The response must explain how the main body of the unit could be manufactured.

Award up to 4 marks based on:

Veneer/ Vacuum Bag.
Moulds/ formers.
Steam bending.
Kerfing. This can be credited but will require the candidate to apply a veneer to the main body of the unit



Simple supporting statement:

- *A vacuum table uses a flexible membrane and an air pump.*

Guidance to markers

Diagram and notes required for 4 marks

Incorrect/ no response	**0 marks**
A simple diagram with limited understanding – limited labelling.	**1 mark**
A more detailed diagram demonstrating understanding - All key parts labelled.	**2 marks**
A detailed diagram supported with labels and a written explanation demonstrating understanding of the forming method.	**3 marks**

Example: (With supporting diagram)

A vacuum table uses a flexible membrane and an air pump.	**2 marks**
A mould is placed on the bed of the vacuum table with the veneers of wood in the correct position. *Once the membrane is sealed over the mould and plywood air is removed from the table forming a vacuum.* *The flexible membrane causes the plywood to form around the mould/former*	**4 marks**

		AO3	AO4	Mark
(c)	State the properties of plywood that make it suitable material for this storage unit.		✓	**2**
	Response must identify the properties of plywood that make it suitable for the unit. *Award 2 marks based on stating two properties* **Guidance to markers** • Strength in all directions • No weakness due to grain. • Can be formed around moulds/ formers • Can be shaped using a kerfing technique. Examples: *No answer or inappropriate answer* **0 marks** Can be easily shaped around a former/mould. **1 mark** Plywood is structurally sound material that can be easily shaped around a former/mould. **2 marks**			

Question 6	For a range of outdoor activities, from family picnics to music festivals, the use of disposable BBQs is both convenient and popular.			
		AO3	**AO4**	**Mark**
(a)	With reference to the contexts above fully explain **four** different issues associated with the use of disposable barbecues.		✓	**8**
	Response could be based on: • *Use of portable BBQs on park furniture and grass areas, this leads to damage as a result of the heat generated by the base of the BBQ.* • *Safety all the utensils and equipment are on the ground people could walk or fall onto them.* • *Concerns over hygiene as all the utensils equipment are at ground level and laid out in contact with the grass.* • *Sociable event with many people engaged in the activity but not focussed on the instant BBQs. BBQs become a hazard at ground level.* **Guidance to markers** Identification of issue Identification of issue with justification *Example:* *Incorrect/no response* The use of portable BBQs can lead to burnt grass and furniture When placed on the ground or a wooden flat surface a portable BBQ can burn the surface as a result of the heat produced by the charcoal in the tray being in contact with the ground or surface *Candidates must identify four different issues, 4 x [2]* *Do not credit repeat responses* ***Accept any other appropriate response***			**1 mark** **2 marks** **0 marks** **1 mark** **2 marks**

		AO3	AO4	Mark
(b)	Design a portable unit that will hold a disposable BBQ. Use annotated 2D and 3D sketches to communicate your idea. A standard size disposable barbecues is 300mm x 300mm x 100mm. Marks will be awarded for: (i) an innovative and portable unit that holds the disposable barbeque. [8] (ii) how the unit meets environmental issues. [4] (iii) how it meets the safety requirements of the user when cooking the food. [4] (iv) the quality of communication and the use of annotated, 2D and 3D drawings. [4]		✓	**20**
	(i) an innovative and portable unit that holds the disposable barbeque. *The response must contain possible **innovative** design features for a portable stand for instant BBQs.* I*nnovative features could include:* *A folding system for the elements of the product allowing it to be portable.* *A temporary joint that allowed for ease of assembly.* *Use of a material i.e. Kevlar.* Incorrect/ no response. Design produced showing no innovative features. Design produced with limited innovative features, some not relevant to the design problem. Design proposed with some innovative features, most relevant to the design problem. Innovative design proposed and clearly relevant to the design problem.			8 **0 marks** **1-2 marks** **3-4 marks** **5-6 marks** **7-8 marks**

	(ii) how the unit meets environmental issues. *The response must identify possible environmental issues concerning the use of portable BBQ**s** and the proposals attempt to address these issues.* *Environmental issues addressed could include:* *Burning the surface that the Portable BBQ rests on.* *Embers/coals from the BBQ setting light to the surrounding area.* *Disposal of the used BBQ.* No issue identified / no response. Candidate highlights an environmental issue. Candidate identifies how the design produced addresses the environmental issue highlighted. Candidate highlights more than one environmental issue. But does not fully illustrate how the design produced addresses these Candidate clearly identifies how the design produced addresses more than one environmental issue **Maximum of 4 marks**	4 **0 marks** **1 mark** **2 marks** **3 marks** **4 marks**
	(iii) how it meets the safety requirements of the user when cooking the food. *The response must identify issues concerning the safe use of portable BBQ**s** when preparing food.* *Safety issues addressed could include:* *Accidental burning through contact with BBQ.* *Hygienic storage of utensils when not in use.* No issue identified / no response. Candidate highlights a safety and Hygiene issue. Candidate identifies how the design produced addresses issue highlighted. Candidate clearly identifies how the design produced addresses safety requirements when cooking the food Candidate clearly identifies safety issues and provides detailed evidence of how the design ensures the food is cooked safely. **Maximum of 4 marks**	4 **0 marks** **1 mark** **2 marks** **3 marks** **4 marks**

	(iv) The quality of communication and use of annotated 2D and 3D drawings. *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. Idea developed with either 2D **or** 3D illustrations only. Idea developed with both 2D **and** 3D illustrations, illustrations provide limited information. Ideas developed with both 2D **and** 3D illustrations, illustrations highlight many design details for the design. Creative use of both 2D **and** 3D illustrations, illustrations demonstrate all details fully explain the design. **Maximum of 4 marks.**	4 **1 mark** **2 marks** **3 marks** **4 marks**

		AO3	AO4	Mark
(c)			✓	**12**
	(i) Give **two** detailed reasons why it is essential that a prototype is made before entering full-scale production. *The response must identify and justify why a prototype is essential prior to full scale production.* ***Guidance to markers*** No mention of material. Identifying a reason. Identified reason with a valid justification. **Maximum 4 marks** Examples: A prototype is the first generation of a manufactured product and will allow the designer/ manufacturer to identify possible faults/ errors in the design prior to the full-scale production. Production prototype will allow the manufacturer to identify suitable production processes and possible standard parts that could be used allowing the efficient and economical production of the product. Candidates must give two detailed reasons. Award 2 x[2] marks for different responses. Do not credit repeat responses **Accept any other appropriate response**			4 **0 marks** **1 mark** **1 mark** **1 mark** **2 marks**
	(ii) The disposable BBQ is made in a developing country and sold in the UK. Discuss the advantages and disadvantages of this practice to the consumer in the UK and to the manufacturer. *The response must identify both advantages and disadvantages for both the consumer and the manufacturer. The response does not need to discuss the benefits for the developing country.* ***Guidance to markers*** *Advantages for the consumer:* • *Cheaper Products.* • *Variety of products available* *Disadvantages for the consumer:* • *Perceived lower quality product.* • *Not supporting domestic economy* *Advantages for the Manufacturer:* • *Lower production/ operational costs, cheaper labour.* • *Fewer regulations allowing for more flexible working conditions.* • *Larger pool of available labour.* • *Production plants closer to raw materials, reducing transport costs.* • *Economical for larger production runs.* • *Competitive advantage.*			8

	Disadvantages for the manufacturer: • *Distance for the transport of the finished products will increase costs* • *Quality control concerns.* • *Regional/ Local political stability.* • *Public relations issues.* • *Communication can be difficult over long distances and different cultures/countries.* • *Lack of flexibility.*	
	Incorrect/ no response **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 concept of global manufacturing. • The candidate will express basic ideas clearly. **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 global manufacturing but they are not always considered in detail. • The candidate will express straightforward ideas clearly. **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 real knowledge of global manufacturing some issues discussed. There are descriptive comments about some elements of the needs of the end user. • The candidate will express moderately complex ideas clearly. **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 regarding Global manufacturing. • There are detailed descriptive comments about specific elements of the manufacturer and the consumer. • The candidate will express complex ideas extremely fluently. ***Accept any other appropriate response***	**0 marks** **1-2 marks** **3-4 marks** **5-6 marks** **7-8 marks**