GCE AS/A LEVEL

WJEC GCE AS/A Level in

DESIGN AND TECHNOLOGY

APPROVED BY QUALIFICATIONS WALES

SAMPLE ASSESSMENT MATERIALS

Teaching from 2017

This Qualifications Wales regulated qualification is not available to centres in England.

For teaching from 2017
For award from 2018

GCE AS AND A LEVEL DESIGN AND TECHNOLOGY

PRODUCT DESIGN

SAMPLE ASSESSMENT MATERIALS

Contents

Candidate Name	Centre Number					Candidate Number				
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GCE AS DESIGN AND TECHNOLOGY

UNIT 1

Product Design

SAMPLE ASSESSMENT MATERIALS

2 hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a calculator.

INSTRUCTIONS FOR CANDIDATES

Answer ALL questions.

Write your name, centre number and candidate number in spaces at the top of this page.

Write your answers in the spaces provided in this booklet.

Use black ink or black ball-point pen.

Do not use pencil or gel pen.

Do not use correction fluid.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part question. You are advised to divide your time accordingly.

The total number of marks available is 80.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question 5.

Q1. Computer aided design/computer aided manufacture (CAD/CAM) is a common method of manufacturing products.

(a) Explain the cutting action used in two different CAM machines. [2]

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(b) Using one example of a product made by using CAM, explain why the process of manufacture is appropriate to the product. [2]

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(c) Explain in detail one benefit of using CAD to the designer and manufacturer. [4]

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Q2. Safe working practice requires procedures to be followed and an awareness of hazards involved, when using equipment in the workshop. Signage uses different shapes and colours to inform health and safety.

(a) Explain the meaning of each coloured shape shown below. [2]

Blue circle with white edge

Yellow triangle with black edge

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(b) Explain the purpose of an image within a safety sign. [2]

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(c) Sketch two examples of safety signs that use a blue circular image and a yellow triangular image. Explain the hazard and one location where you would find each image. [4]

Use sketches as part of your answer.

Sketch 1

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Sketch 2

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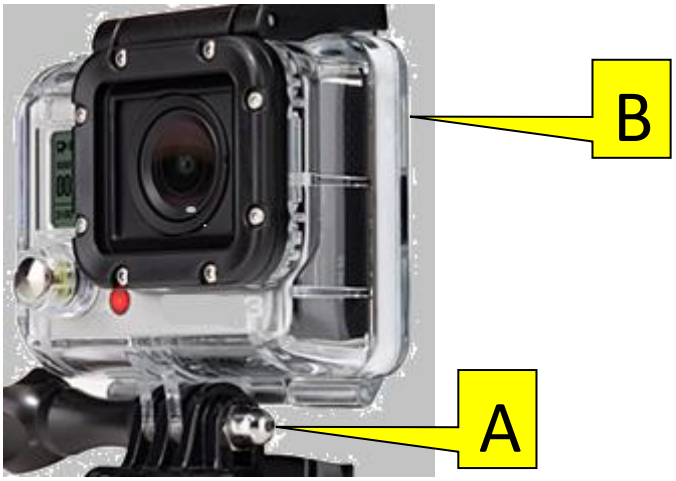
Q3. Products can often be manufactured from a number of parts that are joined together in a permanent or semi-permanent way.

The product below uses a permanent method of joining the waterproof case (A) and a semi-permanent fixing on the base bracket (B). The camera is able to tilt and be locked at different angles.



Waterproof Camera

(a) State the semi-permanent method of joining the fixing on the base (A) and justify why this method has been chosen in relation to the product shown. [4]

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(b) The two parts of the case use a permanent method of fixing (B); they are glued together using a waterproof adhesive. Using notes and sketches explain and justify how the strength of the permanent fixing method could be improved without the use of any other external fixing, such as a nut and bolt. [4]

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Q4. Production processes are used to manufacture products. Shown below is a selfie-stick used to hold mobile phones.

Selfie-stick

Mobile phone holder

The telescopic handle is made by extrusion and the mobile phone holder is made by injection moulding.

Evaluate the suitability of extrusion and injection moulding for these two components. [8]

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Q5. Discuss James Dyson's application of aesthetics and consideration for the user in the design of the product shown. [8]

Marks will be awarded for the content of the answer and the quality of written communication.

James Dyson's Upright Vacuum Cleaner

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Q6. A mobile phone company is looking to redesign its mobile phone charger. The redesign must:

- hold mobile phone securely whilst being charged;
- consider the issues associated with the cable;
- allow the user to use the phone when being charged;
- be compact and portable.

You are to design one mobile phone charger.

Cable details

Typical charger

Mobile phone

(a) Using the information provided analyse and describe any design issues for consideration. [8]

(b) Write a detailed and justified four point specification. [8]

Point 1: .....
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Justification: .....
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Point 2: .....
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Justification: .....
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Point 3: .....
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Justification: .....
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Point 4: .....
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Justification: .....
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In the boxes provided on pages 16 and 17:

(c) Generate one idea for the mobile phone charger using a mixture of 2D and 3D annotated freehand sketches. [8]

(d) As you develop your idea you must show design detailing (shape, form, fixing methods) that you feel answers the problem. [8]

(e) Explain how your choice of materials in terms of the characteristics and properties will support your design idea. [8]

You are not expected to render, colour or shade in your designs.

For continuation only.

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 and Technology (Product Design)

MARK SCHEME

Question 1	Computer aided design / computer aided manufacture (CAD/CAM) is a common method of manufacturing products.			
		AO3	**AO4**	**Mark**
(a)	Explain the cutting action used in two different CAM machines.		✓	2
	The two answers must provide a description of CAM machines: ***1 mark*** *for each response.* Responses may include laser cutting, plasma cutting, CNC router, milling or lathe, 3D printing, rapid prototyping, stereo lithography, sintering. Method stated and a brief description of each method chosen given as an explanation. **Guidance to markers** 1 mark for each description. *Incorrect / no answer* ***0 marks*** *Brief description of one method.* ***1 mark*** Laser cutter machine uses laser light to cut accurately different shapes. Or CNC router uses a cutting bit/tool to cut different shapes.			
(b)	Using one example of a product made by using CAM, explain why the process of manufacture is appropriate.		✓	2
	Answers that demonstrate an understanding of CAM and the product chosen should reflect the understanding for ***2*** *marks based on:* Responses may include laser cut lamp shades, cards, decorations, toys, decorative panels. Etching effects onto materials and decorative textures. CNC routers to manufacture furniture. Milling – mobile phone, laptop housings, car engine parts. Turning – circular parts such as threads, pins, wheels, gears and component parts. 3D printing and rapid prototyping of product models, bottles. **Guidance to markers** Accept any **two** appropriate points *Incorrect / no answer* ***0 marks*** *Brief description.* ***1 mark*** *Polypropylene light shades have intricate shapes cut out using a laser cutter.* *Mobile phones e.g. iPhone can be milled using a CNC milling machine to create the body shape to house the internal components.* *More detailed description.* ***2 marks*** *Polypropylene light shades have intricate shapes cut out using a laser cutter. This process is used to improve accuracy and is a suitable method as it is made from a flat sheet and can be made identical in a variety of colours.* *Mobile phones e.g. iPhone can be milled using a CNC milling machine to create the body shape to house the internal components. Improved accuracy and quality.*			

(c)	Explain in detail one benefit of using CAD to the designer and manufacturer.		✓	4

*Answers that demonstrate an understanding of the benefits of CAD should be awarded up to **4** marks based on:*
Providing a benefit of using CAD to the designer and one benefit to the manufacturer.

Benefit to the designer
More accurate than hand drawn images, save and edit ideas, saves time, modify and update existing ideas, can reduce human error, images and ideas can be sent quickly to others in the design team.

Benefit to the manufacturer

High accuracy in manufacture, prototypes can be trialled before manufacture, consistent results, and speeds up production process.

Guidance to markers

Designer

Incorrect / no answer ***0 marks***

Brief description. ***1 mark***

The benefit to the designer of using CAD is that dimensioned drawings can be edited easily and can be saved electronically to email to different locations.

More detailed description. ***2 marks***

The benefit to the designer of using CAD is that dimensioned drawings can be edited easily and can be saved electronically to email to different locations. The CAD file can also be used to create 3D visuals of the product for client presentations and to promote the product.

Manufacturer

Incorrect / no answer ***0 marks***

Brief description. ***1 mark***

The benefit to the manufacturer of using CAD is that the manufacturer can use the CAD file to produce the prototype from using CAM e.g. a CNC machined product.

More detailed description. ***2 marks***

The benefit to the manufacturer of using CAD is that the manufacturer can use the CAD file to produce the prototype from using CAM e.g. a CNC machined product. The manufacturer can manufacture identical products in different colours or by through using a variety of materials using the CAD drawing. They can also test the product using the CAD file or make a scale model of a product.

Total	**8**

Question 2	Safe working practice requires procedures to be followed and an awareness of hazards involved, when using equipment in the workshop. Signage uses different shapes and colours to inform health and safety.			
		AO3	**AO4**	**Mark**
(a)	Explain the meaning of each coloured shape shown below Blue circle with white edge. Yellow triangle with black edge.		✓	2
	*Answers that demonstrate an understanding of safety signage should be awarded up to **1** mark for each correct response:* **Guidance to markers** *Incorrect / no answer* ***0 marks*** *Description for blue sign.* Blue circular signs with a white contrast are MANDATORY signs you follow. ***1 mark*** *Description for yellow sign.* Yellow equilateral signs with black contrast are WARNING signs indicating a danger exist within the environment. High Voltage, laser, danger flammable material. ***1 mark***			
(b)	Explain the purpose of an image within a safety sign.		✓	2
	*Answers that demonstrate an understanding of the purpose of an image within a safety sign should be awarded up to **2** marks:* *Answer must be specifically about the purpose of the image.* • The image is a meant to inform that there is danger / an issue ahead (1 mark) without the use of text (1 mark). or • A universal image clearly indicates the issues ahead (1 mark) and can be understood by any one person no matter what country they come from (1 mark). (A universal language). **Guidance to markers** *Incorrect / no answer* ***0 marks*** *Brief description* The image informs the viewer that there is danger ahead. ***1 mark*** *Detailed answer* The exact purpose of the image is to inform the viewer that there is danger or a hazard ahead without the need for text. ***2 marks***			

(c)	Sketch two examples of safety signs that use a blue circular image and a yellow triangular image. Explain the hazard and one location where you would find each image. *Use sketches as part of your answer.*		✓	4

*Answers that demonstrate an understanding of safety signs and workshop hazards should be awarded up to **4** marks based on:*

For example

Guidance to markers
Blue circular signs with white contrast.

A poor sketch. ***0 marks***

A clear detailed sketch that resembles the standard sign. ***1 mark***

Description and location. ***1 mark***

A safety sign that uses a blue circular image could be: 'eye protection must be worn'. These signs should be positioned in a visible place by the machine, for example, when using a pillar drill in a workshop to drill a hole in a piece of wood, plastic or metal just in case parts fly off into your face or the drill bit shatters.

Yellow equilateral signs with black contrast
A poor sketch. ***0 marks***

A clear detailed sketch that resembles the standard sign. ***1 mark***

Description and location. ***1 mark***

A safety sign that uses a yellow triangle with black contrast indicates that something is flammable and can catch fire easily. For example; any solvents or finishes display this sign on them. In a workshop, flammable materials and liquids should be kept in a metal container and should display this sign to make people aware of the danger.

Total	**8**

Question 3	Products can often be manufactured from a number of parts that are joined together in a permanent or semi-permanent way. The product below uses a permanent method of joining the waterproof case (A) and a semi-permanent fixing on the base bracket (B). The camera is able to tilt and be locked at different angles.			
		AO3	**AO4**	**Mark**
(a)	State the semi-permanent method of joining the fixing on the base (A) and justify why this method has been chosen in relation to the product shown.		✓	4
	*Answers that demonstrate an understanding of joining methods and include justified comments should be awarded up to **4** marks based on:* **Guidance to markers** *Incorrect / no answer* ***0 marks*** *Brief description.* ***1 mark*** B – A pivoting joint using a domed head nut that screws onto an adjustable handle. This allows the angle of the camera to be adjusted to suit the user depending upon where it is used. *More detailed description.* ***2 marks*** A pivoting joint using a domed head nut that screws onto an adjustable handle. This allows the angle of the camera to be adjusted to suit the user depending upon where it is used. This part needs to be semi-permanent as the camera needs to be removed from the base bracket or the base bracket needs to be attached to something. *More detailed description justified.* ***3 - 4 marks*** A pivoting joint using a domed head nut that screws onto an adjustable handle. This allows the angle of the camera to be adjusted to suit the user depending upon where it is used. The pivot pin locates through a series of holes in the base bracket and the camera case. The domed bolt is part threaded to reduce any possible wear on the case and to allow the handle to lock the fixing into the required position. This part needs to be semi-permanent as the camera needs to be removed from the base bracket or the base bracket needs to be attached to something.			

(b)	The two parts of the case use a permanent method of fixing (B); they are glued together using a waterproof adhesive. Using notes and sketches explain and justify how the strength of the permanent fixing method could be improved without the use of any other external fixing, such as a nut and bolt.		✓	4
	The answer must be about how to increase the strength of the permanent fixing. *To increase the strength of the permanent joint you will need to:* *Increase the contact surface area. This could be done by having a 'V' shaped groove on one half of the case and a 'V' shaped raised surface on the other half.* *Or* *Design a clamp, clip or pin form of joint in the two parts of the case.* **Guidance to markers** Accept any creditable idea that answers the question set. Reminder: no external fixing allowed. *Incorrect / no answer* ***0 marks*** *Simple diagram with appropriate notes that just answers the question.* ***1 mark*** *Annotated diagram with appropriate notes with one simple explanation of how the joint is improved.* ***2 marks*** *Annotated diagram with appropriate notes with explanation of how the joint is improved and is justified.* ***3 marks*** *Detailed diagram with detailed notes and explanations of how the joint is improved and is justified.* ***4 marks***			
			Total	**8**

Question 4	The telescopic handle is made by extrusion and the mobile phone holder is made by injection moulding.			
Evaluate the suitability of extrusion and injection moulding for these two components.		**AO3**	**AO4**	**Mark**
		✓		8

Candidates are required to appraise and/or make judgements about the suitability of extrusion as a method of production for the telescopic handle and injection moulding as a method of production for the mobile phone holder.

Extrusion is a process used to create objects of a fixed cross-sectional profile [1] it is a process that allows for different cross sectional forms to be extruded from simple shapes to quite intricate complex ones [1]. The profile in this case is a simple one but the process must also allow for the tubular cross section to be extruded to the required wall thickness of the telescopic handle [1]. The metal may work harden as it passes through dies therefore it may need to be heated to remove the hardness within the metal [1]. The extrusion process is able to create uniform lengths of tubing which is ideal for the process of manufacturing. The designer can maximize the number of lengths of tubing from the standard length whilst minimizing waste [1].

Guidance to markers

Little or no understanding ***0 marks***

Basic appraisal and/or judgements of the process of extrusion. ***1 mark***

Satisfactory appraisal and/or judgements of the process of extrusion to make the handle ***2 marks***

Good appraisal and/or judgements of the process of extrusion to make the handle ***3 marks***

Very good appraisal and/or judgements of the process of extrusion to make the handle ***4 marks***

	Injection moulding is a manufacturing process for producing parts by injecting a plastic material into a mould [1]. The process is able to produce quite complex forms [1] as in the case of the holder and has the added advantage of producing large quantities quickly [1]. The quality of the moulded form requires very little cleaning or surface finishing [1] and this is advantageous in keeping the final selling price down [1]. **Guidance to markers** *Little or no understanding* ***0 marks*** *Basic appraisal and/or judgements of the process of injection moulding.* ***1 mark*** *Satisfactory appraisal and/or judgements of the process of injection moulding the mobile phone holder.-* ***2 marks*** *Good appraisal and/or judgements of the process of injection moulding the mobile phone holder.-* ***3 marks*** *Very good appraisal and/or judgements of the process of injection moulding the mobile phone holder.-* ***4 marks***	
	Total	**8**

Question 5

		AO3	AO4	Mark
	Discuss James Dyson's application of aesthetics and consideration for the user in the design of the product shown.		✓	8

*Answers that demonstrate an understanding of the designer and his product/aesthetics should be awarded up to **8** marks.*

James Dyson's upright vacuum cleaner revolutionised the market using cyclone technology to improve suction and a bagless design which both gave the product an innovative edge.

Dyson's application of aesthetics made the product look like no other.

He uses plastic injection moulded parts in bright bold colours.

The vacuum cleaner is mainly manufactured from polycarbonate and ABS plastic, which can be injection moulded with suitable tolerances and can be opaque or transparent allowing mechanical parts to be seen by the user.

The product uses a grey and yellow colour scheme, but also interacts with the user as the grey parts are the parts ergonomically designed with the user in mind.

For example, the base of the product pivots and allows the user to angle the main body to suit their height.

The grey handle is removable allowing the user to use the cleaning tools on stair cases and in small spaces. Each of the cleaning tools effortlessly clicks into place mechanically and easily.

The cord storage clips rotate and allow easy cord storage below the handle.

Some parts have an element of surprise with telescopic poles to make the product more durable and suitable for different situations.

The main mechanical parts are highlighted in yellow plastic mouldings.

The cyclones responsible for its powerful, suction are housed above a set of filters that help deposit the dust and dirt into a clear transparent chamber. This allows the user to see when the chamber is full and needs to be emptied.

Dyson has rehearsed each user trip and function thinking about every step, issue and procedure to design a functional product.

The Dyson vacuum cleaner has a clean and dynamic aesthetic look that makes the product a piece of art that people want to have on display rather than being hidden away in a cupboard like its predecessors.

The product looks interesting and has also sparked off other ideas for other products with similar innovative qualities.

Dyson has considered the user of the product along with the maintenance of the product and he has considered how it will be disposed of after its life cycle.

All too often products cannot be repaired as parts are unavailable or cannot be replaced easily. This is the opposite with a Dyson product. In-fact he will replace parts if the faulty part is returned so that he can test it to find out why it had failed or broken.

	Candidates will demonstrate their knowledge of the designer product in their response. Consideration will be given to the structure of their response, and the Quality of Written Communication (QWC). **Guidance to markers** *Focus should be on James Dyson, the product, aesthetics and the user.* No answer or incorrect, no evidence of understanding. ***0 marks***	
Level 1 ***1 - 2 Marks*** • 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.		
Level 2 ***3 - 4 Marks*** • 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		
Level 3 ***5 - 6 Marks*** • 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 James Dyson's philosophies. 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 ***7 - 8 Marks*** • The candidate demonstrates a specific ability to analyse questions, takes into account 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 James Dyson's philosophies. 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.		
	Total	**8**

Question 6				
A mobile phone company is looking to redesign its mobile phone charger. The redesign must: • hold the mobile phone securely whilst being charged; • consider the issues associated with the cable; • allow the user to use the phone when being charged; • be compact and portable. You are to design one mobile phone charger.		**AO3**	**AO4**	**Mark**
(a)	Using the information provided analyse and describe any design issues for consideration.	✓		8
	Consideration of the following points: The question shows an iPhone, which could provide an opportunity for a range of products of varying sizes or an average size for all types of iPhone. The product could fold up to make it more compact and portable. A suction pad may be used to secure the phone to the product or a mechanism. Cable management needs to be an integral part of the design. User interaction and considerations when using the product but also when using the phone whilst charging. Protection of the phone when in use – protective foam pad. Method of holding the charger plug or its use to attach the product to the socket when in use. Consider access to switches on sockets and right and left hand use. Branding – use of company logo. Fit in with brand image. Consider colour range and cases and iPhone colour ranges. Large-scale production. Injection moulding in a range of coloured polymers (plastic). **Guidance to markers** Accept any relevant analytical point up to a total of eight (8) marks.			

(b)	Write a detailed and justified four point specification.		✓	8
	The candidate must write four justified points: The mobile phone charger must allow the user to use the phone whilst it is being charged. The mobile phone must allow the user to easily plug the device into a standard 240v socket and be able to access the on/off switch. The user must be able to plug in any cables to the device and to the phone. The mobile phone device must be portable to allow the user to carry the device without damaging it. The cable management will needs to be considered as cables are easily twisted and this could cause issues with charging the phone. The mobile phone device must be attractive to the user and be easy to use. The device must have three conductive pins to allow the product to fit into a standard wall socket and of course allow power into the device. The device must be suitable for both left and right handed users. The device must be suitable for mass production to allow for thousands to be manufactured. The device must be designed using standard parts to reduce costs. **Guidance to markers** A relevant point that has not been justified. ***1 mark*** Accept any justified specification point that is relevant. ***2 marks*** Minimum of 4 specification points explained. It must…….. or It should …….. or It could ……			
(c)	Generate one idea for the new product using a mixture of 2D and 3D annotated freehand sketches.		✓	8
	Candidates will generate their own individual responses. There MUST be a mixture of 2D and 3D design sketches generated. Sketches should include annotation. **Guidance to markers** The emphasis is on the quality of communication and presentation of design ideas. 2D or 3D images that have very little detail or supporting annotation. ***1 - 2 marks*** Idea developed with both 2D and 3D illustrations, some supporting annotation that is relevant to the design. ***3 - 4 marks*** Ideas developed with both 2D and 3D illustrations, supporting annotation is relevant to the design and indicates a clear understanding of the problem. ***5 - 6 marks*** Ideas developed with both 2D and 3D illustrations, supporting annotation is relevant to the design and indicates a detailed understanding of the problem. ***7 - 8 marks***			

(d)	As you develop your idea you must show design detailing (shape, form, fixing methods, etc.) that you feel answers the problem.		✓	8
	Guidance to markers Incorrect/no answer ***0 marks*** A very basic design with no real design detailing evident. ***1 - 2 marks*** A basic design with some design detailing and some indication of user interaction (shape/form). ***3 - 4 marks*** A design with one or two design details evident and shows how the user interacts with the product (shape/form) and some indication of fixing methods of how the device is to be formed. ***5 - 6 marks*** A design with design detailing, clearly shows how the user interacts with the product (shape/from) and detailed indication of fixings methods of how the device is to be formed. ***7 - 8 marks***			
(e)	Explain how your choice of materials in terms of the characteristics and properties will support your design idea.		✓	8
	Candidates will need to mention specific named materials and why the characteristics and properties are suitable for the design of the mobile phone charger. Polypropylene plastic, ABS, silicon, urea-formaldehyde, rubber, copper or brass alloys etc. *Properties/Characteristics:* We are expecting the candidates to discuss Hardness Toughness Electrical insulation Weight Flexibility Range of colours Finishing Recyclability Conduction of electricity(brass/copper alloys) Resistant to corrosion Texture **Guidance to markers** No mention of specific materials characteristics or properties. ***0 marks*** Very little detail or justification of material selection. ***1 - 2 marks*** Materials named for the product that includes one or two characteristics or properties. ***3 - 4 marks*** Materials named for the product that includes two or three characteristics or properties. **5 - 6 *marks*** Detailed description of named materials for the product that includes four or characteristics or properties. ***7 - 8 marks***			
			Total	**40**

GCE A LEVEL DESIGN AND TECHNOLOGY

UNIT 3

Product Design

SAMPLE ASSESSMENT MATERIALS

2 hours 30 minutes

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a calculator.

INSTRUCTIONS FOR CANDIDATES

Answer ALL questions.

Write your name, centre number and candidate number in spaces at the top of this page.

Write your answers in the spaces provided in this booklet.

Use black ink or black ball-point pen.

Do not use pencil or gel pen.

Do not use correction fluid.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part question. You are advised to divide your time accordingly.

The total number of marks available is 100.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question 10.

Q1. Risk assessments are legal requirements for all manufacturing activities.

(a) Explain two main purposes of risk assessment. [2]

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(b) Explain why a product manufacturer must identify any risks associated with the use of the iron shown below. [2]

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(c) Complete the five stages of a risk assessment plan (the first stage is provided for you).

I. Look for the hazard (anything which may cause harm). [4]

II. .....

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III. .....

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IV. .....

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V. .....

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Q2. (a) Describe how a product qualifies for a patent. [2]

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(b) Name and describe the protection given by three other Intellectual Property Rights [6]

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Q3. (a) Explain the term 'reverse engineering' when used in the design and production of products such as a jug kettle. [4]

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(b) For the product below, explain three important insights a designer might obtain through reverse engineering. [8]

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Q4. (a) State four key benefits of just in time (JIT) to the manufacturer. [4]

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(b) Explain how the use of JIT manufacturing strategies has impacted on product manufacturing. [8]

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Q5. (a) State four features of cell production in a car manufacturing facility. [4]

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(b) Describe the advantages of cell production to the manufacturer. [4]

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Q6. (a) Evaluate the benefits of using a specific smart material in named products. [4]

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(b) Evaluate how the bicycle below has benefited from materials development in its aesthetic and functional styling. [4]

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Q7. (a) Name a material that is classified into each of the following categories:

a. Natural
b. Plastic (synthetic)
c. Regenerated
d. Alloys [4]

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(b) Describe four types of mechanical or physical properties of materials. [8]

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Q8. (a) Explain two advantages of three dimensional modelling (3D) to the product manufacturer. [4]

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(b) Describe the insights the manufacturer will obtain by using this 3D model prior to manufacture. [8]

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Q9. (a) Describe two sustainability issues that should be considered when designing products that bring about the conservation of raw materials. [2]

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(b) Designing and making products recyclable, repairable and with a longer lifetime will lead to better quality, though more expensive products.

Discuss this statement in relation to product design. [6]

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Q10. Product 'production methods' and 'disposal' are important considerations for the product designer.

Analyse the importance of the two areas in relation to designing sustainable products. [12]

Marks will be awarded for the content of the answer and the quality of written communication.

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For continuation only.

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 and Technology (Product Design)

MARK SCHEME

Question 1

		AO3	AO4	Mark
(a)	Explain two main purposes of risk assessment.		✓	2
	*Answers that demonstrate an understanding of a risk assessment should be awarded up to **2** marks based on:* (One mark for each response) 1. To assess the risk to people (health and safety). 2. Risk to environment (pollution). 3. Risk to production process (damage to machinery thus causing delays). **Guidance to markers** *Incorrect / no answer.* ***0 marks*** *Brief explanation of the purpose.* ***1 mark*** To assess the risk to a person and to ensure the person is in a safe working environment.			
(b)	Explain why a product manufacturer must identify any risks associated with the use of the iron shown below.		✓	2
	*Answers that demonstrate an understanding of identifying risks within the electrical product should be awarded up to **2** marks based on:* 1. So that the user is aware of any risks associated with the use or disposal of the product or components used in the construction of the product. 2. Maximum safety voltage. 3. Limitations in environmental use, e.g. bathrooms. 4. Minimise the impact of legal action against the manufacturer. **Guidance to markers** *Incorrect / no answer.* ***0 marks*** *One mark for **each** response.* *Brief description of why manufacturer must identify risks (from the above).* So that the user is aware of any risks associated with the use or disposal of the product or components used in the construction of the product. ***1 mark***			
(c)	Complete the five stages of a risk assessment plan		✓	4
	*Answers that demonstrate an understanding of a risk assessment plan should be awarded up to **4** marks based on:* One mark for each response: 1. Decide who/what may be harmed and how. 2. Evaluate the risks and decide whether existing precautions are adequate or whether more needs to be done. Risk is the chance, high or low, that somebody will be harmed by the hazard. 3. Record the findings. 4. Review the assessments and revise if necessary. ***Guidance to markers*** Do not penalise the candidate if the order is incorrect - we are looking for the stages and understanding. *Incorrect/no answer* ***0 marks*** *Correct description of appropriate stages.* ***1 mark***			
			Total	**8**

Question 2

		AO3	AO4	Mark
(a)	Describe how a product qualifies for a patent.		✓	2
	*Answers that demonstrate an understanding of patents should be awarded up to **2** marks based on:* An invention is patentable only if it is: 1. new and previously undisclosed; 2. distinguished by an inventive step; 3. capable of industrial application (that it could actually be made). **Guidance to markers** *Incorrect / no answer.* ***0 marks*** *Brief description of how the product qualifies (from the above).* ***1 mark*** The product must be a totally new design. *More detailed description of how a product qualifies (from the above).* ***2 marks*** The product must not have any features used in similar products and be a totally original idea.			
(b)	Name and describe the protection given by three other Intellectual Property Rights.		✓	6
	*Answers that demonstrate an understanding of Intellectual Property Rights should be awarded up to **6** marks based on:* **1. Copyright** Protects original literary, dramatic, musical and artistic works. Copyright arises automatically. Recognised internationally. Becomes a property that can be bought, sold, hired or licensed. Lasts until 70 years after the death of the author. **2. Trademark** Any sign which can be represented graphically. Any sign which can distinguish goods or services. Includes words, personal names, designs, letters and the shape of goods and their packaging. Registered for 10 years and can be renewed every 10 years indefinitely. **3. Design Right** A form of protection for the shape or configuration of articles. Design must not be commonplace. It is not a monopoly but a right to prevent copying. It lasts 10 years. Becomes a property that can be bought, sold, hired or licensed. **Guidance to markers** The candidate must give answers based on the three areas above. *Incorrect/no answer* ***0 marks*** *Brief description with little detail.* ***1 mark*** Copyrights protect original literary, dramatic, musical and artistic work. *More detailed description, with an explanation or justification.* ***2 marks*** Copyrights protect original literary, dramatic, musical and artistic work; it means that legal action can be taken up by owner of the copyright. Accept answers that may link to an example, George Harrison, WWF to WWE etc.			
		Total		**8**

Question 3

		AO3	AO4	Mark
(a)	Explain the term 'reverse engineering' when used in the design and production of products such as a jug kettle.		✓	4

*Answers that demonstrate an understanding of reverse engineering should be awarded up to **4** marks based on:*

Responses from:

1. The process of discovering the technological principles of a product, device or system.
2. Analysis of its structure and form.
3. Take something apart and analyse its workings (mechanical, electrical or software).
4. Product development can be accomplished more efficiently and at a substantial cost saving.

Guidance to markers

Incorrect/no answer. ***0 marks***

Brief explanation, very little detail. ***1 mark***

Description of an appropriate process, some detail as outlined above. ***2 marks***

More detailed description of an appropriate process with at least two of the above related to the kettle. ***3 marks***

Fully detailed description of an appropriate process (outlining at least three from the above relating clearly to the kettle). ***4 marks***

(b)	For the product below, explain three important insights a designer might obtain through reverse engineering.		✓	8

*Answers that demonstrate an understanding of reverse engineering should be awarded up to **8** marks based on:*

- Analysis of its function
- Study of its structure
- How the product operates (under different conditions)
- How below the line aspects work (i.e. switches)
- Material consideration
- Manufacturing process
- Safety issues

Guidance to markers

The question requires an explanation of three insights and the bullet points in each band describe typical performance of candidates who have fully met the requirements of the question and referred to three insights.

To achieve a mark in band 3 or band 4, there must be clear reference to three insights. However, in band 1 and band 2, an appropriate quality of response may balance reference to fewer than three insights. This will avoid penalising with a mark of zero a response that does not fully meet the quantity required but which nevertheless demonstrates a degree of understanding.

A mark within band 2 may be achieved with reference to two insights, but the quality of response would need to be better than a candidate achieving a mark within band 2 on the basis of having referred to three insights. A mark within band 1 should be considered irrespective of the number of insights, but the quality of the response needs to be commensurately higher as the quantity of insights reduces.

No answer or no relevant issues described or discussed	0
• Candidate has a simplistic knowledge. • Limited use of terminology and technical language. • The candidate has little understanding of reverse engineering and the insights gained.	1-2
• The candidate has a basic understanding of the issues associated with the question. • Satisfactory use of terminology and technical language.. • The candidate understands the general elements (from the above) of reverse engineering and the insights gained, and has referred to at least two insights in their response.	3-4
• The candidate demonstrates a clear understanding of the issues associated with the question. • Good use of terminology and technical language. • The candidate understands the general elements (above) of reverse engineering and the insights gained, and has referred to three insights in their response.	5-6
• The candidate demonstrates a clear understanding of the issues associated with the question. • Very good use of terminology and technical language. • The candidate understands the features of reverse engineering and the insights gained as detailed above, and has referred to three insights in their response.	7-8

		Total	**12**

Question 4

		AO3	AO4	Mark
(a)	State four key benefits of just in time (JIT) to the manufacturer.		✓	4
	*Answers that demonstrate an understanding of the benefits of JIT should be awarded up to **4** marks based on:* One mark for each response from: 1. Less storage space. 2. Efficient and faster manufacturing systems. 3. Getting products to the customer/consumer quickly. 4. Releasing capital for use elsewhere. 5. No depreciation in material costs. 6. Increased profit margins. **Guidance to markers** *Incorrect/no answer* ***0 marks*** *One benefit with a brief description* ***1 mark*** This is when a manufacturer orders component parts or materials to arrive exactly at the required time to ensure the process of manufacture is not stopped.			

(b)	Explain how the use of JIT manufacturing strategies has impacted on product manufacturing.		✓	8

*Answers that demonstrate an understanding of JIT manufacturing strategies should be awarded up to **8** marks based on:*

Clear descriptions from:

1. Items only move through the production system as and when they are needed.
2. Overproduction – waste from producing more than is needed.

3. Time spent waiting – waste such as that associated with a worker being idle whilst waiting for another worker to pass an item (e.g. such as may occur in a sequential line production process).

4. Transportation/movement – waste such as that associated with transporting/moving items around a factory.

5. Inventory – waste associated with keeping stocks.

Guidance to markers

No answer or no relevant issues described or discussed	0
• Candidate has a simplistic knowledge. • Limited use of terminology and technical language. • The candidate has little or no understanding of JIT strategies.	1-2
• The candidate has a basic understanding of the issues associated with the question. • Satisfactory use of terminology and technical language. • The candidate understands the general elements of JIT strategies and how it has impacted on product manufacture.	3-4
• The candidate demonstrates a clear understanding of the issues associated with the question. • Good use of terminology and technical language. • The candidate understands the general elements of JIT strategies (from the above) and how it has impacted on product manufacture.	5-6
• The candidate demonstrates a clear understanding of the issues associated with the question. • Very good use of terminology and technical language. • The candidate understands the main features of JIT strategies as detailed above and how it has impacted on product manufacture.	7-8

	Total	**12**

Question 5

		AO3	AO4	Mark
(a)	State four features of cell production in a car manufacturing facility.		✓	4
	*Answers that demonstrate an understanding of cell production should be awarded up to **4** marks based on:* Responses from: 1. Teams of people working together. 2. Some individual and shared responsibility. 3. Quality control aspects within the cell. 4. Feeds to a larger system. 5. Cell production has the flow production line split into a number of self-contained units. **Guidance to markers** *Incorrect/no answer* ***0 marks*** *(1 mark for each feature of cell production along with a description.)* Each cell takes more responsibility for its own quality assurance and therefore there is less chance of the finished car failing the final checks. ***1 mark***			
(b)	Describe the advantages of cell production to the manufacturer.		✓	4
	*Answers that demonstrate an understanding of the advantages of cell production to the manufacturer should be awarded up to **4** marks based on:* Responses from: 1. Each team or 'cell' is responsible for a significant part of the finished article and, rather than each person only carrying out one very specific task, team members are skilled at a number of roles, so it provides a means for job rotation. 2. Cell production is a form of team working and helps ensure worker commitment, as each cell is responsible for a complete unit of work. 3. Cells would have responsibility for organising work rosters within the cell, for covering holiday and sickness absences and for identifying recruitment and training needs. 4. Cells deal with other cells as if they were customers, and take responsibility for quality in their area. **Guidance to markers** *Incorrect/no answer* ***0 marks*** *Brief description, very little detail from at least one of the above.* ***1 mark*** *Description of an appropriate advantage, two described with some detail.* ***2 marks*** *More detailed description of appropriate advantages (three described).* ***3 marks*** *Fully detailed description of four advantages.* ***4 marks***			
		Total		**8**

Question 6

		AO3	AO4	Mark
(a)	Evaluate the benefits of using a specific smart material in named products.	✓		4

Candidates are required to appraise and/or make judgements about the benefits of using a smart material in more than one product.

SMART materials could include shape memory alloys, photochromic liquid/inks, thermochromic inks, accept any appropriate smart material.

Benefits could include:

- Strength to weight ratio
- Specific hardness
- Lightness
- Reaction to external stimuli

The candidates should only achieve a mark for evaluating the benefits of the smart material. No marks are to be awarded for the naming of a product.

Exemplar answer

Many modern day spectacles are made from shape memory alloys [1].The major benefit is that if the frames are bent or deformed by accident, they are able to be returned back to their original shape when heated in control conditions [1]. The traditional plastic coated wire frames when deformed or bent out of shape will stay out of shape [1] and the only alternative is to either replace the spectacles or replace the part broken [1].

Guidance to markers

Little or no understanding ***0 marks***

Basic appraisal and/or judgements of the benefits of using a specific smart material in a named product. ***1 mark***

Satisfactory appraisal and/or judgements of the benefits of using a specific smart material in named products. ***2 marks***

Good appraisal and/or judgements of the benefits of using a specific smart material in named products. ***3 marks***

Very good appraisal and/or judgements benefits of using a specific smart material in named products. ***4 marks***

(b)	Evaluate how the bicycle below has benefited from materials development in its aesthetic and functional styling.	✓		4

Candidates are required to appraise and/or make judgements about how the bicycle has benefited from materials development in its manufacture and how its aesthetic and functional development has been influenced by materials development.

Aesthetic
The traditional look of the bicycle has always been based on a triangular form of the frame.
The triangular form is the most appropriate shape to withstand the applied forces.
With the development of modern materials, mainly composites, the frame and look of the bicycle has been has been able to be changed and move away from triangular forms.
This has meant the frame and aesthetics of the bicycle are able to be monocoque in design and aerodynamic forms / styles are now being produced.
Functional

- Lightness
- Less material used
- Safety of driver/rider enhanced significantly
- Consistent properties/characteristics for specific use
- The ability to be formed into complex shapes
- Aerodynamic/ergonomic features

Exemplar answer

Traditionally the triangular frame of the bicycle has been dictated by the ability of the frame to withstand the applied forces [1]. The development in modern materials has meant that styling and aesthetics qualities have been able to be improved because design of the frame has been able to move away from triangular forms without losing any structural integrity [1]. Frames are now able to be slim line and complex aerodynamic forms/shapes are now being able to be created [1]. Another major benefit has been the reduction in the overall weight of the bicycle allowing the rider to be able to cycle faster and use less energy [1].

Guidance to markers

Little or no understanding ***0 marks***

Basic appraisal and/or judgements of the benefits of material development in the aesthetic and functional styling of the bicycle. ***1 mark***

Satisfactory appraisal and/or judgements of the benefits of material development in the aesthetic and functional styling of the bicycle. ***2 marks***

Good appraisal and/or judgements of the benefits of material development in the aesthetic and functional styling of the bicycle. ***3 marks***

Very good appraisal and/or judgements of the benefits of material development in the aesthetic and functional styling of the bicycle. ***4 marks***

	Total	**8**

Question 7

		AO3	AO4	Mark
(a)	Name a material that is classified into each of the following categories. a. Natural b. Plastic (synthetic) c. Regenerated d. Alloys		✓	4
	Answers that demonstrate an understanding of material categories should be awarded 1 mark: Responses from: a. Natural: from cotton, copper, woods, linen, silk, silver, wool. b. Plastic Synthetic: from, acrylic, cellophane, epoxy resin, polyester, polypropylene. c. Regenerated: from paper, viscose, MDF, chipboard, block board d. Alloys: Aluminium alloys, Brass, Bronze, Steel, Stainless steel **Guidance to markers** *Incorrect/no answer* ***0 marks*** *Name of material within a category.* ***1 mark*** .			

(b)	Describe four types of mechanical or physical properties of materials.		✓	8

*Answers that demonstrate an understanding of mechanical or physical properties of materials should be awarded up to **8** marks based on:*
Responses from:

Compressive strength - is the capacity of a material to withstand directed pushing forces. When the limit of compressive strength is reached, materials are crushed.

Ductility - is a mechanical property that describes the extent into which solid materials can be plastically deformed without fracture. In materials science, ductility specifically refers to a material's ability to deform under tensile stress; this is often characterised by the material's ability to be stretched into a wire.

Hardness - is the measure of how resistant solid matter is to various kinds of permanent shape change when a force is applied. Macroscopic hardness is generally characterised by strong intermolecular bonds. However, the behaviour of solid materials under force is complex; therefore there are different measurements of hardness: *scratch hardness*, *indentation hardness*, and *rebound hardness*.

Shear strength - in engineering is a term used to describe the strength of a material or component against the type of yield or structural failure where the material or component fails in shear. In structural and mechanical engineering the shear strength of a component is important for designing the dimensions and materials to be used for the manufacture/construction of the component (e.g. beams, plates, or bolts).

Guidance to markers

The answers must include four different properties.

Incorrect/no answer ***0 marks***

Named property with limited understanding of the property.

1 mark

Ductility is how a material is able to bend.

Named property with a clear understanding of the property.

2 marks

Ductility is the ability of a material to be stretched or bent without undergoing any physical change to its overall strength.

	Total	**12**

Question 8

		AO3	AO4	Mark
(a)	Explain two advantages of 3 dimensional modelling (3D) to the product manufacturer		✓	4

*Answers that demonstrate an understanding of 3D modelling should be awarded up to **4** marks based on:*

Responses from:

a. Conversion through to Computer Aided Manufacture (CAM).
b. Transfer of models to other manufacturing locations.
c. Enables concurrent engineering.
d. Costs lowered by continuous use.
e. Testing product performance before manufacturing.
f. Materials tests carried out.

Guidance to markers

Incorrect/no answer ***0 marks***

Brief advantage, very little detail ***1 mark***

The manufacturer is able to produce a 3D product quickly.

Explanation of an appropriate advantage, some detail relating to the product manufacturer. ***2 marks***

The manufacturer is able to produce a 3D product and then carry out tests to check its overall function.

(b)	Describe the insights the manufacturer will obtain by using this 3D model prior to manufacture.		✓	8

*Answers that demonstrate an understanding of 3D modelling should be awarded up to **8** marks based on:*

a. Processes may be planned for each component part (tooling produced, jigs and templates).
b. Specific physical tests may be carried out (compression and tensile tests).
c. Model may be animated to test function.
d. Assembly planning, preparing for manufacture.
e. Evaluating materials (through simulations).
f. Scale drawings produced.
g. Viewing the model in particular environments.

Guidance to markers

No answer or no relevant issues described or discussed	0
• Candidate has a simplistic knowledge. • Limited use of terminology and technical language. • The candidate has little understanding of what will be gained by using the model prior to manufacture.	1-2
• The candidate has a basic understanding of the issues associated with the question. • Satisfactory use of terminology and technical language. • The candidate understands some of the insights the manufacturer will gain by using the model prior to manufacture.	3-4
• The candidate demonstrates a clear understanding of the issues associated with the question. • Good use of terminology and technical language. • The candidate understands the insights the manufacturer will gain by using the model prior to manufacture.	5-6
• The candidate demonstrates a clear understanding of the issues associated with the question. • Very good use of terminology and technical language. • The candidate clearly understands the insights the manufacturer will gain by using the model prior to manufacture.	7-8

	Total	**12**

Question 9

		AO3	AO4	Mark
(a)	Describe two sustainability issues that should be considered when designing products that bring about the conservation of raw materials.	✓		2
	*Answers that demonstrate an understanding of sustainability issues should be awarded up to **2** marks based on:* Responses from: 1. Using timber from managed plantations. 2. Using recyclable plastics instead of metals. 3. Using fewer components in a product. 4. Issues relating to the use of less material e.g. veneers instead of solid wood. 5. Extending the product's life span. 6. Can be designed so that there is provision for servicing and repair. **Guidance to markers** *Incorrect / no answer* ***0 mark*** *Brief evaluation of sustainability issues from the above.* ***1 mark*** Electrical products use components that could be easily recycled and this would save on natural materials that are in short supply. e.g. Copper.			
(b)	Designing and making products recyclable, repairable and with a longer lifetime will lead to better quality, though more expensive products. Discuss this statement in relation to product design	✓		6
	*Answers that demonstrate an understanding of making products recyclable, repairable with a longer lifespan should be awarded up to **6** marks based on:* *Recyclable products* – producing products that are easily disassembled for recycling, and have the correct materials for recycling. *Repairable products* – producing parts for the product that are easily repaired. *Longer lifetime products* – using better/improved materials and manufacturing methods. Responses will also consider higher costs in relation to the above. Consideration of future products will be important to any successful response– stating possible benefits to the consumer, designer and manufacturer. Candidates will evaluate how designers will influence the future in relation to sustainable products. **Guidance to markers** *Incorrect/no answer* ***0 marks*** *Brief evaluation, very little detail provided.* ***1 mark*** *Evaluation of the statement, some detail relating to at least one of the above areas which may include reference to cost.* ***2 marks*** *More detailed evaluation in relation to products in at least two of the above including reference to cost.* ***3 - 4 marks*** *Fully detailed evaluation in relation to future products including making products recyclable, repairable and with a longer lifetime leading to better quality, though more expensive.* ***5 - 6 marks***			
		Total		**8**

Question 10

		AO3	AO4	Mark
	Product 'production methods' and 'disposal' are important considerations for the product designer. Analyse the importance of the two areas in relation to designing sustainable products.	✓		12

*Answers that demonstrate an understanding of product production methods and disposal considerations for designing sustainable products should be awarded up to **12** marks based on:*

Responses based on:

1. Production methods:

Specific material used in the manufacturing process.
Selection process – linked to manufacturing and possible product disposal.
Environmental impact in selecting a particular material.

2. Disposal:

Which processes were used to make the product?
What is the impact of this process?
Function and purpose of the product which affects disposal.
Different parts of the product and how do they work together.

Candidates could also discuss:

The more complex the design the more stages of manufacture, therefore drawing on more equipment and fixtures.

The designer should consider the waste issue: is he/she maximising the number of pieces he/she can get from a length of wood - basically trying to eliminate waste in any form.

Finishes and modern adhesives often use CFCs which are harmful to the environment. Designers could consider natural finishes such as wax etc.

Review the life cycle of the product, could it be designed to perform more than one function and it could be designed to last 'X' number of years the design could help with influencing our throw away culture.

Could the product be designed so that when it has reached its life expectancy, the parts and fixtures could be recycled?
The designer could consider using more recycled material/components in the design.

Pollution: there will be waste - how it will be disposed of? Could it be reused? Biodegradable materials.

6Rs could be discussed within the design of the furniture.

Energy issues may be discussed.

If it is a one off design then issues like energy may not be such a massive problem compared to batch or mass production.

Eco design - designing a product from scratch where the environment becomes the client.

Life cycle analysis - how we measure the impact of a product on our environment. Cradle to grave situations.
Government legislation: is the designer aware of what they are?

• Candidate has a simplistic knowledge. • Limited use of terminology and technical language. • Response considers some aspects at a basic level in relation to designing sustainable products. • Response demonstrates basic awareness of manufacturing methods. • Very few if any environmental issues highlighted (as above) by the candidate. • Quality of Written Communication is limited, presenting material with limited coherence, many errors of grammar, punctuation and spelling.	1-3
• The candidate has a basic understanding of the issues associated with the question. • Satisfactory use of terminology and technical language. • Response considers the two areas superficially. • Response demonstrates some awareness of manufacturing methods (above). • A range of environmental issues highlighted by the candidate (above). • Quality of Written Communication is basic, presenting occasional appropriate material with some coherence, some errors of grammar, punctuation and spelling.	4-6
• The candidate demonstrates some understanding of the issues associated with the question. • Good use of terminology and technical language. • Responses must consider the two areas in relation to designing sustainable products (above). • Response demonstrates some awareness of manufacturing methods. • A range of environmental issues highlighted by the candidate. • Quality of Written Communication is good, presenting mainly appropriate material in a coherent manner, few errors of grammar, punctuation and spelling.	7-9
• The candidate demonstrates a clear understanding of the issues associated with the question. • Very good use of terminology and technical language. • Responses must consider the two areas in relation to designing sustainable products. Environmental, cultural and moral issues will feature in high level responses. • Response demonstrates good awareness of manufacturing methods. • A range of environmental issues highlighted by the candidate (energy, cost, investment, environmental footprint). • Product *production methods* and *disposal* are the important considerations clearly outlined for the product designer. • Quality of Written Communication is excellent, presenting wholly appropriate material in a coherent and logical manner, hardly any errors of grammar, punctuation and spelling.	10-12

Guidance to markers:
We are looking for an extended essay that will discuss production methods, disposal and sustainable products.

	Total	**12**