



GCE A LEVEL MARKING SCHEME

SUMMER 2023

**A LEVEL
DESIGN AND TECHNOLOGY - UNIT 3
PRODUCT DESIGN
1603U30-1**

INTRODUCTION

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

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

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

GCE A LEVEL DESIGN AND TECHNOLOGY

UNIT 3 – PRODUCT DESIGN

SUMMER 2023 MARK SCHEME

Guidance for examiners

Positive marking

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

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

Banded mark schemes

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

The indicative content suggests the range of issues which may be included in the learner's answers. It can be used to assess the quality of the learner's response. Indicative content is **not** intended to be exhaustive and learners **do not** have to include all the indicative content to reach the highest level of the mark scheme.

In order to reach the highest levels of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that it contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

In Design and Technology, each question addresses one assessment objective: either AO3 or AO4. The assessment grid sub-divides the total mark to allocate for a question. These are shown in bands in the mark scheme. For each question, descriptors will indicate the different skills and qualities at the appropriate level.

Examiners should first read and place a tick in the learner's answer/s to indicate the evidence that is being assessed in that question; the mark scheme can then be applied. This is done as a two stage process.

Stage 1 – Deciding on the band

Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptors for that band. If the descriptors at the lowest band are satisfied, examiners should move up to the next band and repeat this process for each band until the descriptors match the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark learners down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Question 1

The speaker design below is at the development stage of the iterative design process.		AO3	AO4	Mark
(a)	Explain one benefit and one drawback of freehand sketching versus CAD modelling.		✓	[4]
<p><i>Answers that indicate an understanding of benefits and drawbacks should be awarded up to 4 marks based on:</i></p> <p>Benefits:</p> <ul style="list-style-type: none"> • Sketches can be done anywhere to save time. • Sketches can be done quickly so ideas are not forgotten. • There are hardly any costs involved to sketching compared to CAD. • Sketches can be easily annotated to convey ideas. <p>Drawbacks:</p> <ul style="list-style-type: none"> • It is difficult to sketch complex designs to be able to express more detailed ideas. • Editing or changing the drawing is less easy compared to CAD modelling. • Sketches are difficult to share with other designers in other places. • CAD designs can be tested and simulated, however sketching can't. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i></p> <p><i>Either one benefit or drawback not explained, for example:</i> Sketches can be drawn and produced anywhere.</p> <p><i>One benefit and one drawback not explained, for example:</i> Sketches can be drawn and produced anywhere; however, sketches can be difficult to change.</p> <p><i>Benefit and drawback with clear explanations, for example:</i> Sketches are beneficial due to them being easily drawn and produced anywhere, this enables quick idea generation and saves time rather than creating more complex CAD designs. On the other hand, editing and changing the drawing/sketch is more difficult.</p> <p><i>More detailed benefit and drawback with clear explanations, for example:</i> Sketches are beneficial due to them being easily drawn and produced anywhere, this enables quick idea generation and saves time rather than creating more complex CAD designs. On the other hand, editing and changing the drawing/sketch is more difficult compared to CAD where different design versions can be created easily.</p> <p><i>Award maximum of 2 marks for one benefit. Maximum of 2 marks for one drawback.</i></p>				0 1 2 3 4

(b)	Explain two key aspects of aesthetics that need to be considered when developing the design proposal for the speaker.		✓	[4]
<p><i>Answers that indicate an understanding of the consideration of aesthetics should be awarded up to 4 marks based on:</i></p> <ul style="list-style-type: none"> • An aesthetic design trend is composed of elements that create a distinct visual personality from considerations such as: • Form • Shape • Proportion – layout of controls • Colour • Materials • Finish • Texture • Typography – Branding and features such as on/off and volume <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i> 0</p> <p>One consideration given with no explanation, for example: An aesthetic consideration for the speaker would be colour. 1</p> <p>Two considerations given with no explanations, for example: An aesthetic consideration for the speaker would be colour and form. 2</p> <p><i>Detailed considerations with clear explanations, for example:</i> The speaker design will need to consider a range of aesthetics. One of these considerations would be colour, where the colour trends of the time would need to be considered. Another aesthetic consideration would be the texture of the materials and finishes as this could create more appeal. 3</p> <p><i>More detailed considerations with clear explanations, for example:</i> The speaker design will need to consider a range of aesthetics. One of these considerations would be colour, where the colour trends of the time would need to be considered to ensure the speaker design is suitable for the target market. In terms of colour the speaker design could consider using different colours for different target markets. Another aesthetic consideration would be the texture of the materials and finishes as this could create more appeal. 4</p>				
Total				8

Question 2

As part of their research strategy, a designer is looking to carry out reverse engineering on the competitor product below.		AO3	AO4	Mark
(a)	Describe what is meant by the term 'reverse engineering'.		✓	[2]
<p><i>Answers that indicate an understanding of reverse engineering should be awarded up to 2 marks based on:</i></p> <ul style="list-style-type: none"> • Reverse engineering is the process by which an object is deconstructed and taken apart to extract knowledge and reveal its designs, electronics, materials, manufacturing processes or assembly in order to duplicate or refine/improve a product. • Redesign of the product as a result of taking it apart. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect / no answer</i></p> <p><i>Brief description, a simple fact, for example:</i> Reverse engineering is when an existing product is taken apart and deconstructed and then redesigned as a result.</p> <p><i>More detailed description with understanding, for example:</i> Reverse engineering is the process by which an object is deconstructed and taken apart to extract knowledge and reveal its how it has been made and assembled to inform further design development or to duplicate aspects of the design.</p>				0
				1
				2

(b)	Discuss how the designer can benefit from carrying out reverse engineering on the competitor product.		✓	[6]
<p><i>Answers that indicate an understanding of benefits for reverse engineering to the consumer should be awarded up to 6 marks based on:</i></p> <p>Benefits:</p> <ul style="list-style-type: none"> • To be able to learn from the product and influence their own design or improve it as a result. • Ability to understand the working components of the drill including the electronics, motors and battery. • Assembly of parts can be determined. • Manufacturing techniques could be determined. • Materials can be determined. • Speed control and gearing can be identified. • Technical calculations can be carried out to determine functional capabilities. <p>Answers need to refer to the battery drill and no other products.</p> <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <ul style="list-style-type: none"> • Incorrect/no answer 0 • Candidate has a simplistic knowledge. • The use of terminology and technical language is basic. • Brief description of one to two benefits of carrying out reverse engineering on the battery drill; little understanding evident with basic examples. 1-2 • Candidate has some basic understanding of the issues associated with the question. • The use of terminology and technical language is variable. • Some detail discussion of three to four benefits of carrying out reverse engineering on the battery drill with some explanation and examples. 3-4 • The candidate has clear understanding of the issues associated with the question. • The use of terminology and technical language is mostly accurate. • More detailed discussion of three to four benefits of carrying out reverse engineering on the battery drill with more detailed knowledge and understanding evident; appropriate examples included. 5-6 				
Total				8

Question 3

A homeowner is looking to upgrade their security by installing a new smart lock.		AO3	AO4	Mark
(a)	Before developing the new smart lock, primary research was carried out. Identify a method of primary research and describe the main benefit to the designer.		✓	[2]
<p><i>Answers that identify and describe a method of primary research should be awarded up to 2 marks based on:</i></p> <p>Types of primary research:</p> <ul style="list-style-type: none"> • Interviews • Surveys • Focus groups • Observations of existing products • Questionnaires • Reverse engineering/ product disassembly <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i></p> <p>One method of primary research named</p> <p>One method of primary research named along with a description of the benefit, for example:</p> <p>Interviews could be carried out with the target market/client. This form of research would benefit the development of the product to gain an understanding of the needs and wants to help ensure the product is effective.</p>				0 1 2
(b)	Explain how the selection of materials and components relate to the price and performance of the two types of locks above.		✓	[4]
<p><i>Answers that indicate an understanding of how material and component selection relate to the price and performance should be awarded up to 4 marks based on:</i></p> <ul style="list-style-type: none"> • Answer needs to identify and explain how the cost and materials/components are related. • More technology used in new lock makes it more expensive. • More components used in smart lock. • Range of materials used in smart lock could make it more expensive. • More manufacturing processes needed for smart lock. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i></p> <p><i>Simplistic or basic response, for example:</i></p> <p>The new lock uses more modern materials that would make it more expensive.</p> <p><i>Basic explanation, for example:</i></p> <p>The new lock uses more modern materials and electronic components that would make it more expensive to manufacture and the costs of sourcing materials would increase.</p>				0 1 2

	<p><i>More detailed explanation, for example:</i> The new lock compared to the old lock is more expensive due to the electronic functions that would need to be incorporated. This will increase the manufacturing processing costs due to the more complex components required.</p> <p><i>Fully detailed explanations of a range of factors, for example:</i> The new lock compared to the old lock is more expensive due to the electronic functions that would need to be incorporated. This will increase the manufacturing processing costs due to the more complex components required along with the more complexing tooling and machinery required. The new lock also incorporates software to be controlled by a mobile app which would increase the costs of manufacturing.</p>			3
				4
(c)	Discuss the innovative use of technology incorporated into the new smart lock to benefit the consumer.		✓	[6]
	<p><i>Answers that discuss an understanding of the technologies that have been incorporated to benefit the consumer should be awarded up to 6 marks based on:</i></p> <ul style="list-style-type: none"> • Smart locks incorporate Wi-Fi and Bluetooth for easy access from smart phones and devices. • Improving security due to the fingerprint and electronic locking systems. • The technology in smart door locks can alert you when doors open and close. • Do not need to worry if you locked the doors or not as you can check on your phone's app. • There's no need to keep a physical house key or hide one outside as a spare. • Smart locks eliminate the need to make copies of physical keys. • Smart locks can let you grant access to multiple people and track who comes in and out of your home any time of the day or night. • Smart locks can be incorporated to be used in conjunction with existing smart devices such as Alexa. <p>Accept any other appropriate response</p>			
	<ul style="list-style-type: none"> • Incorrect/no answer 			0
	<ul style="list-style-type: none"> • Candidate has a simplistic knowledge. • Brief discussion of one benefit; little understanding evident; basic discussion of the technology incorporated into the smart lock. 			1-2
	<ul style="list-style-type: none"> • Candidate has clear understanding of the issues associated with the question. • More detailed discussion of two to three benefits with more detailed knowledge and understanding evident; appropriate discussion of relevant technologies included in the smart lock. 			3-4
	<ul style="list-style-type: none"> • Candidate demonstrates very clear understanding of the issues associated with the question. • Uses correct terminology and technical language. • Full and detailed discussion of three to four benefits with full and detailed explanation of the technologies included in the smart lock. 			5-6
Total				12

Question 4

The one-piece salad container below has been manufactured by vacuum forming.	AO3	AO4	Mark
(a) State the name of an appropriate polymer that can be used to create the one-piece salad container and explain the properties that make it a suitable material.		✓	[4]
<p><i>Answers that indicate an understanding of reasons for choice of polymer should be awarded up to 4 marks based on:</i></p> <ul style="list-style-type: none"> • Polymer – HIPS - high impact polystyrene sheeting • PET – Polyethylene terephthalate • PLA – Polylactic acid, or polylactide <p>Properties to include:</p> <ul style="list-style-type: none"> • Easily vacuum formed due to low melting point. • Good malleability, plus its adherence to moulds when using low pressures is good. • HIPS can be recycled and this therefore minimizes the effect on the environment. • Can be chemically resistant to allow for food storage. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i></p> <p><i>Identification of polymer, for example:</i> HIPS can be used for the one-piece salad container.</p> <p><i>Identification of polymer and description of one property, for example:</i> The salad container can be made from HIPS. The main property of this polymer is it can be easily vacuum formed due to its low melting temperatures.</p> <p><i>Identification of polymer and some explanations of key properties, for example:</i> A suitable polymer would be HIPS. This polymer has many properties that make it suitable such as a good malleability, plus its adherence to moulds when using low pressures is good.</p> <p><i>Identification of polymer and full explanations of key properties, for example:</i> A suitable polymer would be HIPS. This polymer has many properties that make it suitable such as a good malleability, plus its adherence to moulds when using low pressures is good. HIPS can also be recycled and this therefore minimizes the effect on the environment.</p>			<p>0</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p>

(b)	Using notes and sketches, explain the features required to produce a successful industrial former for the one-piece salad container.		✓	[8]	
<i>Answers that indicate an understanding of the features of a vacuum forming mould should be awarded up to 8 marks based on:</i>					
<ul style="list-style-type: none"> • The mould must be designed with a working hinge to make it one piece. • Ridges within the mould should be shown and explained to show understanding of why they are used to create more strength. • Texture points could be identified at corner where the container is opened. • Draft angle on mould should be used to allow for easy withdraw of material. • Lid and top of main container section should have male and female lugs to allow for the container to stay closed. 					
Accept any other appropriate response					
Guidance to markers					
<ul style="list-style-type: none"> • Incorrect/no answer 					0
<ul style="list-style-type: none"> • Candidate has a simplistic knowledge. • The use of terminology and technical language is basic. • Brief discussion of one to two features of the mould; little understanding evident; basic sketches. 					1-2
<ul style="list-style-type: none"> • Candidate has some basic understanding of the issues associated with the question. • The use of terminology and technical language is variable. • Some detail discussion of three to four features of the mould with some explanation and sketches. 					3-4
<ul style="list-style-type: none"> • The candidate has clear understanding of the issues associated with the question. • The use of terminology and technical language is mostly accurate. • More detailed discussion of three to four features of the mould with more detailed knowledge and understanding evident; appropriate detailed sketches included. 					5-6
<ul style="list-style-type: none"> • The candidate demonstrates very clear understanding of the issues associated with the question. • Uses correct terminology and technical language. • Full and detailed discussion of three to four features of the mould with full and detailed explanations with highly relevant sketches included. 					7-8
Total				12	

Question 5

Veneered chipboard is used in the construction of the desk shown below.		AO3	AO4	Mark
(a)	Explain two advantages of using veneered chipboard compared to a natural timber when manufacturing the top of the desk.		✓	[4]
<p><i>Answers that indicate an understanding of the advantages of chipboard should be awarded up to 4 marks based on:</i></p> <ul style="list-style-type: none"> • Chipboard is inexpensive and can make use of recycled wood in its manufacture. • Can be manufactured into bigger sheet boards. • Can be manufactured into different thicknesses. • Can be veneered to improve aesthetics. • Is cheaper than some natural timbers. • Doesn't contain any knots and defects so is easy to cut and work with. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i></p> <p>One advantage given with no explanation, for example: An advantage of chipboard is that it can be manufactured into bigger sheets/boards.</p> <p>Two advantages given with no explanations, for example: An advantage of chipboard is that it can be manufactured into bigger sheets/boards. A second advantage is that it can be cheaper than some natural timbers.</p> <p><i>More detailed advantages with clear explanations, for example:</i> An advantage of chipboard is that it can be manufactured into bigger sheets/boards. A second advantage is that it can be easy to work with due to the lack of knots and defects within the chipboard compared to natural timber.</p> <p><i>Full detailed advantages with very clear explanations that link to the product, for example:</i> An advantage of chipboard is that it can be manufactured into bigger sheets/boards, this makes it a suitable material to make furniture as large sheets of natural timber is more expensive and can increase costs. A second advantage is that it can be easy to cut and achieve a good finish with a veneer due to the lack of knots and defects within the chipboard compared to natural timber.</p>				0
				1
				2
				3
				4

(b)	Discuss the issues related to joining separate parts of veneered chipboard to construct the desk and how these can be successfully overcome.		✓	[4]
<i>Answers that indicate an understanding of the disadvantages of chipboard should be awarded up to 4 marks based on:</i>				
<ul style="list-style-type: none"> • Knock down fittings are normally used; however, this technique isn't as strong as using traditional wood joints. • Can be difficult to join due to screws and nails not biting into the material. • Chipboard is not as strong compared to natural wood and can warp if not glued and fixed correctly. • Veneered side and edges need to be correctly assembled to ensure a good finish. • Pilot holes could be used before screwing however due to the nature of the chipboard having no grain the screws will not bite into the material and the chipboard can crack and expand on its edge. • Dowel joints could be used; however, these can be difficult to line up if not machined using CAM techniques. 				
Accept any other appropriate response				
Guidance to markers				
<i>Incorrect/no answer</i>				
0				
<i>Issue identified with no explanation, for example:</i>				
It can be difficult to join chipboard together due to it splitting easily when screws are used.				
1				
<i>Issue identified with a suggestion to overcome, for example:</i>				
It can be difficult to join chipboard together due to it splitting easily when screws are used. To overcome this problem, knock down fittings can be used to ensure a strong join.				
2				
<i>Issues identified with a brief suggestion to overcome, for example:</i>				
It can be difficult to join chipboard together due to it splitting easily when screws are used. To overcome this problem, knock down fittings can be used to ensure a strong join. Chipboard is not as strong compared to natural wood and can warp if not glued and fixed correctly.				
3				
<i>Range of issues identified with clear suggestions to overcome, for example:</i>				
It can be difficult to join chipboard together due to it splitting easily when screws are used. To overcome this problem, knock down fittings can be used to ensure a strong join, however this technique isn't as strong as using traditional wood joints. Chipboard is not as strong compared to natural wood and can warp if not glued and fixed correctly. Dowel joints could be used; however, these can be difficult to line up if not machined using CAM techniques.				
4				
Total				8

Question 6		AO3	AO4	Mark
The sweet dispenser below has been manufactured as a prototype before going into batch production.				
(a)	Discuss why a jig would be used in the batch production of Part A .		✓	[2]
<p><i>Answers that indicate an understanding a benefit of a jig should be awarded up to 2 marks based on:</i></p> <ul style="list-style-type: none"> • Jigs can improve productivity. • Jigs can improve consistency of accuracy and repetition of tasks during manufacture. • Jigs give rapid production work. • Jigs can reduce manufacturing costs. • Makes sure that parts are similar or the same every time. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect / no answer</i></p> <p><i>Brief description of one benefit, for example:</i> A benefit of using a jig would be that it can improve productivity.</p> <p><i>Detailed discussion of one benefit, for example:</i> A benefit of using a jig would be that it can improve productivity. This is due to the jig allowing for the manufacturing tasks to be repeated quickly and accurately. For example, using a jig to drill holes in part A in the same place each time.</p>				0
				1
				2

(b)	Using notes and sketches design a possible jig to batch produce Part A .		✓	[6]
<i>Answers that indicate an understanding of jigs should be awarded up to 6 marks based on:</i>				
Example 1:				
Example 2:				
Accept any other appropriate response				
Guidance to markers				
Candidates could answer this question in terms of developing a jig to cut the part to length, mark the holes and also drill the holes. Higher tariff answers will have an understanding of all of these aspects to help batch produce part A.				
<ul style="list-style-type: none"> • Incorrect/no answer • Candidate has a simplistic knowledge. • A basic jig designed with basic sketches, lacking detail to show understanding of how a jig can be used. • Candidate has some basic understanding of the issues associated with the question. • A clear jig design with clear annotated sketches. Main details identified to show understanding of how a jig can be used. • The candidate has clear understanding of the issues associated with the question. • A fully explained jig design with very detailed annotated sketches. All key details identified to show a full understanding of how a jig can be used to improve accuracy. 				<p>0</p> <p>1-2</p> <p>3-4</p> <p>5-6</p>
Total				8

Question 7		AO3	AO4	Mark
Just in Time (JIT) production is a manufacturing system that is used worldwide.				
(a)	Explain the meaning of Just in Time (JIT) production.		✓	[2]
<p><i>Answers that indicate an understanding of JIT should be awarded up to 2 marks based on:</i></p> <ul style="list-style-type: none"> JIT is a manufacturing system in which materials or components are delivered ready for production immediately before they are required in order to minimise storage costs. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i></p> <p><i>Brief description of JIT, little detail, for example:</i> JIT is when materials are ordered when needed.</p> <p><i>More detailed explanation of JIT with clear understanding, for example:</i> JIT is a manufacturing system in which materials or components are delivered ready for production immediately before they are required in order to minimise storage costs.</p>				0
				1
				2

(b)	Evaluate how Just in Time (JIT) affects the manufacturer when producing laptop computers.	✓		[10]	
<i>Answers that indicate an understanding of benefits and limitations of JIT should be awarded up to 10 marks based on:</i>					
Benefits include:					
<ul style="list-style-type: none"> • Lower stock holding means a reduction in storage space, which saves rent and insurance costs. • As stock is only obtained when it is needed, less working capital is tied up in stock. • Less likelihood of stock perishing, becoming obsolete or out of date. • Less time is spent on checking and re-working production as the emphasis is on getting the work right first time. • Parts can be bought in and manufactured by others to save time. 					
Limitations include:					
<ul style="list-style-type: none"> • There is little room for mistakes as minimal stock is kept for re-working faulty products. • Production is highly reliant on suppliers and if stock is not delivered on time, the whole production can stop and be delayed. • There are no spare finished products available to meet unexpected orders. • A need for complex, specialist stock systems. Usually in the form of digital systems. 					
Accept any other appropriate response					
Guidance to markers					
<ul style="list-style-type: none"> • Incorrect/no answer 					0
<ul style="list-style-type: none"> • Candidate has a simplistic knowledge. • The use of terminology and technical language is basic. • Brief description of the benefits and limitations of JIT; little understanding evident; basic or no example. 					1-2
<ul style="list-style-type: none"> • Candidate has some basic understanding of the issues associated with the question. • The use of terminology and technical language is variable. • Some detail with some understanding of the benefits and limitations of JIT which have been briefly explained. 					3-4
<ul style="list-style-type: none"> • The candidate has a clear understanding of the issues associated with the question. • The use of terminology and technical language is mostly accurate. • More detailed evaluation of the benefits and limitations of JIT with clear knowledge and understanding evident; appropriate examples included to aid evaluation. 					5-6
<ul style="list-style-type: none"> • The candidate has a very clear understanding of the issues associated with the question. • The use of terminology and technical language is accurate. • More detailed evaluation of the benefits and limitations of JIT with detailed knowledge and understanding evident; detailed examples included to aid evaluation. 					7-8
<ul style="list-style-type: none"> • The candidate demonstrates an excellent understanding of the issues associated with the question. • Uses correct terminology and technical language including types of materials and processes. • Full and detailed description and understanding of the benefits and limitations of JIT with full and detailed explanation with highly relevant exemplars included. 					9-10
Total				12	

Question 8		AO3	AO4	Mark
The following products have been manufactured from a range of materials suitable for their uses.				
(a)	<p>Pizza Box Describe the properties of corrugated cardboard that make it suitable for the pizza box.</p>		✓	[4]
<p><i>Answers that indicate an understanding of reasons for choice of material should be awarded up to 4 marks based on:</i></p> <p>Properties to include:</p> <ul style="list-style-type: none"> • Cardboard is easy to cut and fold to a box shape using a die cutter. • Is a food safe material, the pizza will not be contaminated. • Is an insulating material which will help keep the pizza warm. • Corrugated card is a lightweight material which makes it easy to carry on delivery. • Pizza box is a single use product, corrugated card is easily recycled so box should not contribute to landfill. • Corrugated cardboard will biodegrade so won't contribute to landfill. • Can be incinerated easily. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i></p> <p><i>Identification of property, for example:</i> Corrugated cardboard can be used for the pizza box due to it being easy to fold.</p> <p><i>Description of one property, for example:</i> The pizza box can be made from corrugated cardboard because the box is a single use product, corrugated card is easily recycled.</p> <p><i>More detailed description of range of properties, for example:</i> The pizza box can be made from corrugated cardboard because the box is a single use product. Corrugated card is easily recycled and reduces landfill and improves environmental footprint. Another property is cardboard is easy to cut and fold to a box shape using a die cutter.</p> <p><i>Fully detailed descriptions of range of properties, for example:</i> The pizza box can be made from corrugated cardboard because the box is a single use product. Corrugated card is easily recycled and reduces landfill and improves environmental footprint. Another property is cardboard is easy to cut and fold to a box shape using a die cutter, resulting in the pizza boxes being able to be stored flat and folded when needed.</p>				0 1 2 3 4

(b)	Liquid detergent bottle Describe the properties of HDPE that make it suitable for the liquid detergent bottle.		✓	[4]
<p><i>Answers that indicate an understanding of reasons for choice of material should be awarded up to 4 marks based on:</i></p> <p>Properties to include:</p> <ul style="list-style-type: none"> • HDPE is a thermoplastic and can be easily blow moulded which is the process used to make the bottle shape. • HDPE is a thermoplastic, can easily be recycled which is important for a short life product • Chemical resistance will not degrade due to the contents. • Chemical resistant will not contaminate/react with the contents it is holding. • Impact resistant will not break if dropped. • Can be pigmented to show brand colours. • Available in transparent so the user can see how much content is left in the bottle. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i> 0</p> <p><i>Identification of property, for example:</i> HDPE is a thermoplastic and can be easily blow moulded. 1</p> <p><i>Description of one property, for example:</i> HDPE is a thermoplastic and can easily be recycled which is important for a short life product to reduce the environmental impact. 2</p> <p><i>More detailed description of range of properties, for example:</i> HDPE is a thermoplastic and can easily be recycled which is important for a short life product to reduce the environmental impact. As HDPE is a thermoplastic it can be easily blow moulded which is the process used to make the bottle shape. 3</p> <p><i>Fully detailed descriptions of range of properties, for example:</i> HDPE is a thermoplastic and can easily be recycled which is important for a short life product to reduce the environmental impact. As HDPE is a thermoplastic it can be easily blow moulded which is the process used to make the bottle shape. Another property is its chemical resistance resulting in the bottle not degrading due to the contents. 4</p>				

(c)	Kettle Describe the properties of stainless steel that makes it suitable for the kettle.		✓	[4]
<p><i>Answers that indicate an understanding of reasons for choice of material should be awarded up to 4 marks based on:</i></p> <p>Properties to include:</p> <ul style="list-style-type: none"> • Stainless steel is a non-ferrous metal, this means it will not rust so the water is safe to drink. • Stainless steel is malleable and can be formed easily in an industrial environment to a curved shape. • Stainless Steel is chemical resistant so the kettle can be cleaned easily with detergents. • Stainless steel is malleable so is easy to use for spinning. • Can be aesthetically pleasing because of its shiny colour. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <p><i>Incorrect/no answer</i> 0</p> <p><i>Identification of property, for example:</i> 1 Stainless steel can be used as it will not rust so the water is safe to drink</p> <p><i>Description of one property, for example:</i> 2 Stainless steel is a non-ferrous metal, this means it will not rust so the water is safe to drink.</p> <p><i>More detailed description of range of properties, for example:</i> 3 Stainless steel is a non-ferrous metal, this means it will not rust so the water will be safe to drink. Another property is that stainless steel can be aesthetically pleasing due to its shiny finish.</p> <p><i>Fully detailed descriptions of range of properties, for example:</i> 4 Stainless steel is a non-ferrous metal, this means it will not rust so the water will be safe to drink. Stainless Steel is also chemical resistant so the kettle can be cleaned easily with detergents. Another property is that stainless steel can be aesthetically pleasing due to its shiny finish that will make it more appealing to modern kitchen designs.</p>				
Total				12

Question 9

Before design and manufacturing takes place, companies will carry out feasibility studies.	AO3	AO4	Mark
Discuss the factors that will need to be considered during a feasibility study.		✓	[8]
<p><i>Answers that indicate an understanding of feasibility studies should be awarded up to 8 marks based on:</i></p> <ul style="list-style-type: none"> • Feasibility studies are used to determine the viability of an idea, such as ensuring a project is legally and technically feasible as well as economically justifiable. • It tells us whether a project is worth the investment—in some cases, a project may not be achievable. • Technical Feasibility - focus on the technical resources available to the company. It helps companies determine whether the technical resources meet capacity and whether the technical team is capable of converting the ideas into working systems. • Scheduling Feasibility - In scheduling feasibility, a company estimates how much time the project will take to complete. • Operational Feasibility – This examines how the operation of the project can be achieved and analyse current resources and any other resources such as manufacturing processes that might be needed. • Economic Feasibility - involves a cost/ benefits analysis of the project, helping companies determine the cost, viability and benefits associated with a project before financial resources are allocated. • Legal Feasibility - whether any aspect of the proposed project conflicts with legal requirements such as patents and trademarks. • The importance of a feasibility study is based on a company’s desire to ensure things are right before committing resources, time, or budget. • A feasibility study might uncover new ideas that could completely change a project’s scope and identify new opportunities. <p>Accept any other appropriate response</p> <p>Guidance to markers</p> <ul style="list-style-type: none"> • Incorrect/no answer 0 • Candidate has a simplistic knowledge. • The use of terminology and technical language is basic. 1-2 • Brief description of one to two factors of feasibility studies; little understanding evident; basic examples. • Candidate has some basic understanding of the issues associated with the question. • The use of terminology and technical language is variable. 3-4 • Some detail discussion of three to four factors of feasibility studies with some explanation and examples. • The candidate has clear understanding of the issues associated with the question. • The use of terminology and technical language is mostly accurate. 5-6 • More detailed discussion of three to four factors of feasibility studies with more detailed knowledge and understanding evident; appropriate examples included. 			

	<ul style="list-style-type: none"> • The candidate demonstrates very clear understanding of the issues associated with the question. • Uses correct terminology and technical language. • Full and detailed discussion of four factors of feasibility studies with full and detailed explanation with highly relevant exemplars included. 	7-8
Total		8

Question 10

Analyse the importance of using the ‘circular economy’ to improve the social, environmental and economic future of product development.

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

AO3

AO4

Mark

✓ (10)

✓ (2)

[12]

Candidates should demonstrate knowledge and understanding and apply it to circular economy to be awarded up to 12 marks based on:

- Circular economy is an alternative to a traditional linear economy (make, use, dispose)
- Within circular economy resources are in use for as long as possible, extracting the maximum value from them whilst in use.
- Products are then recovered and regenerated into other products and materials at the end of the products life.
- Circular economy can create new opportunities for growth of companies and improve social and moral issues relating to the design of products.

Environmental benefits include:

- Reducing waste.
- Products developed to be reusable along with some parts being replaced instead of throwing the whole product out.
- Help reduce the environmental impacts of our production and consumption in both the UK and abroad.
- Reduction in carbon footprint.
- Development of more renewable energy sources.

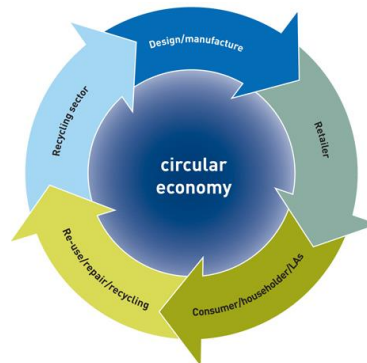
Social benefits include:

- Better address emerging resource scarcity issues in the future.
- Satisfies consumer demand for better, longer lasting products.
- Social circular economy could use Cradle to Cradle concepts to formulate products.

Economic benefits include:

- Deliver a more competitive economy.
- Could create new jobs in areas of high unemployment.

Accept any other appropriate response



In order to be awarded full marks candidates need to address all three issues: social, environmental and economic.

<p>Guidance to markers</p> <ul style="list-style-type: none"> • Incorrect / no answer • Limited understanding and application of knowledge and understanding of circular economy. • There is limited evidence of relevant examples. • Quality of Written Communication is limited, presenting material with limited coherence, many errors of grammar, punctuation and spelling. • Generally good understanding and application of knowledge and understanding of circular economy. • There is a line of reasoning which is generally coherent and relevant. • Quality of Written Communication is basic, presenting occasional appropriate material with some coherence, some errors of grammar, punctuation and spelling. • Very good understanding and application of knowledge and understanding of circular economy and how it links with the social, environmental and economic future of products. • There is a sustained line of reasoning which is generally coherent, relevant and substantiated. • Quality of Written Communication is good, presenting mainly appropriate material in a coherent manner, few errors of grammar, punctuation and spelling. • Excellent understanding and application of knowledge and understanding of circular economy and how it links with the social, environmental and economic future of products. • There is a sustained line of reasoning which is coherent, relevant and substantiated. • Quality of Written Communication is excellent, presenting wholly appropriate material in a coherent and logical manner, hardly any errors of grammar, punctuation and spelling. 	0
	1-3
	4-6
	7-9
	10-12
Total	12