



GCE AS MARKING SCHEME

SUMMER 2023

**AS
DESIGN AND TECHNOLOGY – PRODUCT DESIGN
B602U10-1**

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.

EDUQAS GCE AS DESIGN AND TECHNOLOGY - COMPONENT 1

PRODUCT DESIGN

SUMMER 2023 MARK SCHEME

Marking guidance for examiners

Summary of assessment objectives for Component 1

The questions on this exam paper assess aspects of AO3 and all of AO4.

Within AO3, this exam paper assesses:

Analyse and evaluate –

- *wider issues in design and technology*

Within AO4, this exam paper assesses:

Demonstrate and apply knowledge and understanding of –

- *technical principles*
- *design and making principles*

In the mark grids, the marks allocated to assessment objectives are shown with respect to specific elements:

AO3 2a	analyse wider issues in design and technology
AO3 2b	evaluate wider issues in design and technology
AO4 1a	demonstrate knowledge of technical principles
AO4 1b	demonstrate understanding of technical principles
AO4 1c	apply knowledge and understanding of technical principles
AO4 2a	demonstrate knowledge of designing and making principles
AO4 2b	demonstrate understanding of designing and making principles
AO4 2c	apply knowledge and understanding of designing and making principles

The structure of the mark scheme

In low-tariff questions, the mark scheme includes indicative content which should be used to assess the quality of the candidate's response. The content is not prescriptive and candidates are not expected to mention all material referred to. Examiners should seek to credit any further relevant evidence offered by the candidates.

In high-tariff questions, the mark scheme has two parts:

- An assessment grid showing bands and associated marks that should be allocated to responses which demonstrate the characteristics required by the appropriate assessment objectives relevant to the question
- Indicative content which should be used to assess the quality of the specific response. The content is not prescriptive and candidates are not expected to mention all material referred to. Examiners should seek to credit any further relevant evidence offered by the candidates.

Applying the mark scheme

Stage 1 - Deciding on the band

Beginning at the lowest band, examiners should look at the candidate's response and check whether it matches the descriptor for that band. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer. Examiners should not seek to mark candidates 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 candidate'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.

Indicative content is also provided for banded mark schemes. Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a candidate 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 is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

Where questions target multiple assessment objectives, an answer may deserve to be awarded marks from different bands for different assessment objectives. Where questions target more than one element within an assessment objective, and those elements are conflated and not considered separately within the mark scheme, examiners must not attempt to apportion marks within that assessment objective by element.

In summary:

- the first stage for an examiner is to use both the indicative content and the assessment grid to decide the overall band;
- the second stage is to decide how firmly the characteristics expected for that band are displayed;
- thirdly, a mark for the question is awarded.

Section A

Question 1

The image below shows a high-quality cake serving set made from stainless steel with 18% chromium and 8%nickel.

- Describe **two** properties of stainless steel that make it appropriate for the cake serving set.
- Explain **two** functional qualities to be considered when designing the cake serving set.
- Explain **one** advantage of using batch production when manufacturing the cake serving set.

	Science	Maths		AO3		AO4						Total
						1a	1b	1c				
(a)						4						4

Candidates should demonstrate understanding and are awarded up to 4 marks

Award 1 mark for each property of stainless steel that makes it appropriate for the cake serving set and 1 mark for the justification up to a total of 4 marks.

- Stainless steel has very good resistance to corrosion [1] and will therefore will not contaminate food products.[1].
- Stainless steel is much harder/tougher than low carbon steels [1] that is ideal for the wear the product will go through over time.[1]
- Stainless steel has a high aesthetic value and will maintain its appearance over time [1] therefore it will maintain a high-quality finish [1]
- Stainless steel can be strengthened through work hardening [1] enabling the manufacturer to increase the strength of the product [1]

Credit any other appropriate response.

Q1	Science	Maths		AO3		AO4						Total
						1a	1b	1c				
(b)	✓						4					4
Candidates should demonstrate application of knowledge and understanding and are awarded up to 4 marks. Award 1 mark for a description and 1 mark for a justification or appropriate supporting explanation up to a total of 4 marks. • The product shape/contour needs to be considered [1] to enable the products to be comfortably held [1]. • The composition of the stainless steel needs to be considered [1] to ensure the knife has the required strength to carry out its purpose [1]. • The composition of the stainless steel needs to be considered [1] to ensure the knife will not corrode over time/will last [1]. • The weight of the product needs to be considered [1] to ensure that the product is easy to use but maintains its strength. [1] • The sizing/dimensions of the knife blade need to be considered [1] to ensure the set can be used on a variety of cake sizes. [1] <i>Credit any other appropriate response.</i>												
(c)						2						2
Candidates should demonstrate knowledge and are awarded up to 2 marks Award 1 mark for an advantage and 1 mark for a justification or appropriate supporting comment up to a total of 2 marks. If the product starts to reduce in sales the production can be stopped or altered [1] therefore enabling the manufacturer to adapt quickly to the market and meet the needs of consumers tastes and demands. Batch production utilises machines and quality control measures [1] enabling identical products to be of higher quality [1]. Batch production allows the manufacturer to produce the correct quantity to supply demand [1] therefore requiring no surplus/no waste material/lower production costs [1] Batch production can utilise automation [1] therefore making it cheaper to produce [1] Further editions can be produced at later dates [1] therefore enabling the product to have a longer life [1] Limited editions can create a 'collector's item' [1] where the product will become very desirable and increase in value [1] <i>Credit any other appropriate response.</i>												

Question 2

The use of CAD/CAM has been used in the design and production of a hairdryer.

- (a) Explain **two** advantages to the manufacturer when using CAD modelling in the design of the hairdryer
- (b) Explain how disassembly of an existing hairdryer may also help the manufacturer in the design of the hairdryer.

The formula for calculating power is $\text{power} = \text{energy}/\text{time}$. Power is measured in Watts (W), Energy is measured in Joules (J), Time is measured in seconds (s)

- (c)
 - (i) The hairdryer transfers 120000 J of energy in one minute. What is the power rating of the hairdryer?
Show all workings.
 - (ii) The cost of using the hairdryer is 14p per kilowatt used. Calculate how much it would cost to run the hairdryer for 15 minutes.
Show all workings.
 - (iii) Below is a table showing the winter usage of the central heating system in a home.

System	Power rating watts	Use per day	Pence per kilowatt
Central Heating	15 000	6 hours	14

In the summer months the amount of time the central heating system is used is reduced by 70%.

Calculate the cost per day of running the central heating system in the summer months rounded to a whole pence.
Show all workings.

Q2	Science	Maths		AO3		AO4						Total
						1a	1b	1c	2a			
(a)							4					4
Candidates should demonstrate application of knowledge and understanding and are awarded up to 4 marks. 1 mark for a naming an advantage of CAD and 1 mark for a justification or supporting reason up to a total of 4 marks Areas of the product that can be improved are easily identified [1] without the cost of making prototypes [1] The design can be tested in simulations [1] to ensure that the product will work as effectively as possible [1] The design can be produced quickly [1] therefore speeding up the design process [1] The design can be easily changed or modified [1] enabling the designer to improve the product in an iterative way [1] CAD modelling is a digital process [1] and can be seen more sustainable than making 3D prototypes [1] CAD modelling creates digital files [1] that can be used for collaborative design as files can be emailed/shared [1] <i>Credit any other appropriate response.</i>												
(b)						2						2
Candidates should demonstrate application of knowledge and understanding and are awarded up to 2 marks. 1 mark for an advantage of disassembly to the manufacturer in the design of the hairdryer and 1 mark for a justification or supporting reason up to a total of 2 marks The way in which the hairdryer works can be investigated [1] to see what improvements can be made [1]. Competitor's products can be analysed [1] to give feedback on how they produce and manufacturer their products [1]. A number of products can be taken apart to identify standardised components and parts [1] to enable the manufacturer to identify methods of cutting down manufacturing costs at the design stage [1]. <i>Credit any other appropriate response.</i>												

Q2	Science	Maths		AO3		AO4						Total
						1b						
(c) (i)		2				2						2
Candidates should demonstrate understanding and be awarded up to 2 marks based on: Power= energy /time $P=120000/60$ 1 mark $P= 2000W$ or $2Kw$ Do not credit if W or Kw is not present 1 mark <i>Credit any other appropriate mathematical response.</i>												
(c) (ii)		4				4						4
Candidates should demonstrate understanding and be awarded up to 4 marks based on: Convert Watts to Kilowatts = $2000/1000 = 2kw$ 1 mark Multiply kW by time used - 15 mins = 0.25 of an hour 1Mark = $2kw \times 0.25 = 0.5 kWh$ used overall during the use of the hairdryer for 15mins 1 mark Multiply kWh used by pence per kw = $0.5 \times 14p = 7p$ cost to use 1 mark Allow for carry forward errors from (c) (i) The question is referring to Kilowatts Hour – do not penalise responses that do not use KiloWatts Hour												

Q2	Science	Maths		AO3		AO4						Total
						1b						
(c) (iii)		4				4						4

Candidates should demonstrate understanding and be awarded up to 2 marks based on:

Convert watts to kilowatts: $15000/1000 = 15\text{kw}$ **1 Mark**

X time used = 6 hours * 15 = 90kwh used in total **1 mark**

X pence per kwh = $90 * 14\text{p} = 1260$ pence per day **1 mark**

Reduce by 70% = $1260 * 0.3 = 378$ pence per day or £3.78 **1 mark**

Credit any other appropriate mathematical response.

The question is referring to Kilowatts Hour – do not penalise responses that do not use KiloWatts Hour

Question 3

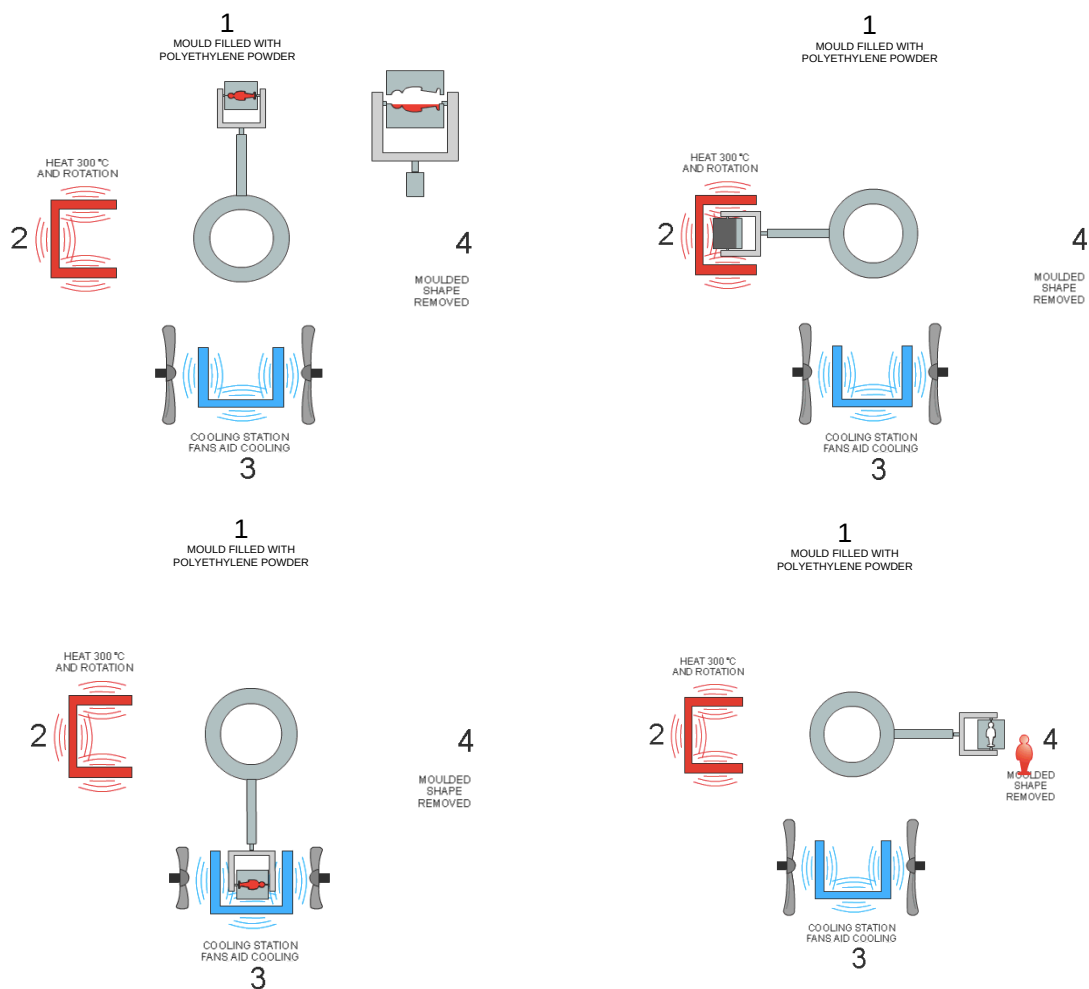
Study the image below showing children's toys.

- (a) Use notes and diagrams to describe how the toys have been made using rotational moulding.
- (b) Explain **two** properties that make polyethylene suitable for this product.

	Science	Maths		AO3		AO4						Total
						1a	1b	1c	2a			
(a)						4						4

Candidates should demonstrate knowledge and are awarded up to 4 marks.

The candidate should produce a diagram with appropriate supporting notes to be awarded the full 4 marks. Award up to 3 marks for appropriate notes without diagrams. Award up to 3 marks for detailed diagrams but without any appropriate notes.



1. The mould opens and is filled with powdered polyethylene and closed.
2. Mould is heated to resulting in the polymer turning into a liquid state.
3. At the same time the mould rotates so that the powder is forced against the wall of the mould.
4. The mould moves onto the cooling stage. Cool air is blown around the mould, aided by large fans. The mould cools slowly and solidifies.
5. The finished product is then removed.

Credit any other appropriate response.

Q3	Science	Maths		AO3		AO4						Total
								1c				
(b)	✓							4				4

Candidates demonstrate knowledge and are awarded up to 4 marks based on:

Award 1 mark for each benefit and 1 mark for a justification or appropriate supporting comment up to a total of 4 marks.

Polyethylene has resistance to water [1] making it suitable for a product that may be used outside [1]

Polyethylene is durable [1] making it ideal for a children's toy, which may take a lot of wear and tear. [1]

Polyethylene can be recycled [1] and therefore is better for the environment [1]

Polyethylene is a relatively cheap material [1] keeping the cost down for consumers [1]

Award no marks for saying that polypropylene is suitable because it can be rotationally moulded.

Credit any other appropriate response.

Question 4

The small bottles pictured below are for carrying liquids abroad, meeting airport regulations.

The following symbol is printed onto the bottom of the bottles.



- (a) Name a suitable material for the bottle and explain what the symbol means.
- (b) (i) Using the information on the diagram below. Calculate the volume of liquid, in centilitres that the bottle can take up to the fill line.
Show all workings.
- (ii) Each bottle costs 5.7p to manufacture. A major supermarket chain requires 10 000 units.
The manufacturer wants to make 25% profit. What would the manufacturer quote to the supplier as the whole cost of the 10 000 units?
- (c) The bottles have been blow moulded. Explain why this is a suitable method of production for this product.

	Science	Maths		AO3		AO4					Total
						1a	1b	1c			
(a)	✓					2					2

Candidates should demonstrate knowledge and are awarded up to 2 marks.
Award 1 mark naming an appropriate material and 1 mark for a suitable explanation of the symbol up to 2 marks.

The purpose of the number is to identify the type of plastic used for the product such as polycarbonate, polyactide, acrylic and nylon [1], not all plastics are recyclable or even reusable. There are numerous plastic-based products that cannot break down and cannot be recycled. [1]

Credit any other appropriate response.

Q4	Science	Maths		AO3		AO4					Total
						1a	1b	1c			
(b) (i)	✓	3						3			3
Candidates should demonstrate knowledge and understanding and be awarded up to 3 marks based on: <i>Convert measurements to cm – calculate volume</i> $14.5 \times 5 \times 4$ $= 290\text{cm}^3$ 1 mark <i>Calculate litres</i> $1 \text{ litre} = 1000\text{cm}^3$ $290/1000 = 0.29\text{litres}$ 1 mark <i>Convert litres to centilitres</i> $0.29 \times 100 = 29\text{cl}$ 1 mark Accept any appropriate mathematical process.											
(b) (ii)	✓	2						2			2
Candidates should demonstrate knowledge and understanding and be awarded up to 2 marks based on: Calculate full cost of manufacture $0.057 \times 10000 = 570$ 1 mark Calculate 25% increase and add to total $570 \times 0.25 = 142.5$ Total = $570 + 142.50 = £712.50$ 1 Mark Accept any appropriate mathematical process.											
(c)							2				2
Candidates should demonstrate an understanding and are awarded up to 2 marks. Award 1 mark for a benefit and 1 mark for a justification or appropriate supporting comment up to a total of 2 marks. Blow moulding is a cheap method of production [1] reducing the unit cost of manufacture [1] Blow moulding is a fast and continuous production method [1] making it ideal for large volume production [1] The manufacturer can use different colour pellets [1] to increase the range of the product [1] <i>Credit any other appropriate response.</i>											

Question 5

The bevel gears below are made from high carbon steel. The gears have been made using the sintering process.

- (a) Describe **two** reasons why sintering is a suitable manufacturing method for this product.
- (b) Describe **two** advantages of using high carbon steel for the manufacturing of the bevel gears.
- (c) Explain how 3D modelling can aid the engineer in prototyping mechanical components such as the bevel gears shown opposite.

	Science	Maths		AO3		AO4					Total
						1a	1b	1c			
(a)						4					4

Candidates should demonstrate knowledge and are awarded up to 4 marks.

Award 1 mark for an explanation and 1 mark for a justification or appropriate supporting comment up to a total of 4 marks.

The powder metallurgy process [sintering] is a precision metal forming technology well suited to producing gears.

Sintering is a process well suited to making complex shapes [1] making it ideal for gears and components that would be harder to make using other processes [1]

Sintering can produce high dimensional accuracy [1] which is required to ensure that the gears can mesh correctly [1]

Sintering can include porosity [1] which enables the gears to contain oil lubricant to ensure they work more effectively [1]

Sintering can have excellent surface finish [1] which improves the performance of the gears [1]

Sintered products tend to be 5-25% lighter than wrought iron products [1] improving the performance of the product [1]

Sintered products have micro-porosity [1] which helps with vibration dampening on gears [1]

Credit any other appropriate response.

Q5	Science	Maths		AO3		AO4					Total
						1a	1b	1c			
(b)							4				4
Candidates should demonstrate understanding and be awarded 4 marks Award 1 mark for each description and 1 mark for a justification or appropriate supporting comment up to a total of 4 marks. Carbon steel has good toughness [1] making it appropriate for gears that require resistance to wear and tear [1] Carbon steel has high strength to weight ratio [1] making it appropriate for gears that require resistance to wear and tear [1] High carbon steel is much harder than low carbon steel because of the increased carbon content [1] making it more suitable for engineered and mechanical components [1] Carbon steel can be quenched to make it harder [1] therefore enabling the product to have increased strength and durability [1] Credit any other appropriate response.											
(c)							2				2
Candidates should demonstrate understanding and be awarded 2 marks Award 1 mark for each description and 1 mark for a justification or appropriate supporting comment up to a total of 2 marks. 3D modeling is a rapid prototyping process [1] enabling the designer to test ideas out quickly [1] 3D modeling is a relatively cheap process [1] therefore cutting down on design and manufacturing costs [1] Modifications and changes can be done quickly [1] enabling the designer to test out ideas quickly in an iterative way [1] Credit any other appropriate response.											

Question 6

Explain how and why the designer has used the Art Deco style to produce this retro DAB radio.

	Science	Maths		AO3	AO4					Total
					1a	1b	1c	2a	2b	
					1			4		5

Candidates should demonstrate understanding and are awarded up to 5 marks based on:

Retro means a style that is derived from the recent past. It intends to create a nostalgic feeling towards the past and in fashion, we use the word retro to refer to the revival of old yet relatively recent styles [1] this appeals to a certain consumer who likes styled products that remind them of the past but with new technologies [1]

Retro products can be more unique for the consumer [1] can be very different to the normal high street products that can be purchased [1]

The styling can reflect the tastes of the consumer [1] and can help to show their individuality [1]

Art Deco, also called style modern, movement in the decorative arts and architecture that originated in the 1920s and developed into a major style in western Europe and the United States during the 1930s. ... Art Deco design represented modernism turned into fashion [1]

Characteristics employed in the radio – art deco influenced

Emphasised geometric forms [1]

Symmetrical Forms [1]

Vivid contrast of surface qualities and colour [1]

Candidates should address the reasons why a designer has used Art Deco Styling to produce the DAB Radio, which should be exemplified with features of Art Deco to access full marks.

Credit any other appropriate response.

Question 7

Below is a modern hand-held tablet.

- (a) Analyse how modern smart materials have been used in the design and manufacture of the hand-held tablet.
- (b) Regarding the hand-held tablet, evaluate how planned obsolescence affects both the consumer and the manufacturer.

	Science	Maths		AO3		AO4				Total
				2a	2b	1c	2a	2b	2c	
(a)				4				2		6

Candidates should show evidence of deconstructing information to find connections and provide logical chains of reasoning, and then apply this to be awarded up to 6 marks.

Indicative content:

Smart materials have properties that react to changes in their environment. This means that one of their properties can be changed by an external condition, such as temperature, light, pressure or electricity. This change is reversible and can be repeated many times.

Examples of smart materials in a tablet

Quantum-tunnelling composite

Quantum-tunnelling composite (QTC) is a flexible polymer, which contains tiny metal particles. It is normally an insulator but if it is squeezed it becomes a conductor.

QTC can be used to make membrane switches like those used on tablets.

Touchscreen technology utilises Indium Tin Oxide ITO

This is made into an electricity-conducting film screen, ITO allows us to interact with our screens via our fingers and gestures.

Piezoelectric – On applying a mechanical stress to these materials it generates an electric current. These are common in the buttons to turn the tablet on and off, home buttons and volume control.

Piezoelectric microphones transform changes in pressure caused by sound waves into an electrical signal – this is the technology used to make Siri work.

Piezo Transducer – using a thin layer of piezoelectric material, small transducers vibrate when an electrical charge is passed through them and can generate sound.

Credit any other appropriate response.

Band	Marks	AO3 2a	Marks	AO4 2c
2	3-4	Good analysis of the use of smart materials in a handheld tablet. A sound discussion, which deconstructs information and provides adequate connections and reasoning. Generally well-considered and relevant factors used as a context for the discussion	2	Applies a sound knowledge and understanding of designing and making principles to the context of using smart materials in a tablet.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited analysis of the use of smart materials in a handheld tablet. Little evidence of deconstructing information and limited connections are made. Few factors are identified.	1	Applies a basic knowledge and understanding of designing and making principles to the context using smart materials in a tablet.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

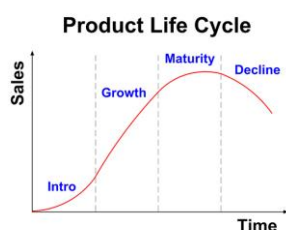
Q7	Science	Maths		AO3		AO4				Total
				2a	2b	1c	2a	2b	2c	
(b)					4	2				6

Candidates should show clear evidence of appraisal and/or making judgements and then apply this to technical principles to be awarded up to 6 marks.

Indicative Content

Planned obsolescence, or built-in obsolescence, product design is a policy of planning or designing a product with an artificially limited useful life, so it will become obsolete after a certain period of time.

Planned obsolescence usually leads to the decline of a product in the product life cycle as manufacturers introduce new products to replace them rather than repair or supplying new components, or by not introducing new software updates to support the product.



Planned obsolescence helps manufacturer's to maintain revenue.

Manufacturers have to support a product, which results in a cost such as technical support and software updates. Each model that is discontinued being supported will save the manufacturer the cost. Consumers inevitably lose out as their products become less and less usable and may fail, resulting in the consumer having to buy a new product.

A technology product usually has a limited lifespan [push-pull technology] where consumers want the latest innovations. This technological innovation costs the manufacturer.

The manufacturer may hold new features and developments for the next product iteration. This may result in consumer dissatisfaction.

Planned obsolescence can have a negative effect on the environment as it can encourage consumers to purchase new models when their current one still works.

Additionally, it places more stress on natural resources and creates more waste and pollution in the production of new models.

There is also the potential backlash of consumers who learn that the manufacturer invested money to make the product obsolete faster; such consumers might turn to another producer (if any exists) that offers a more durable alternative.

Types of planned obsolescence

Contrived durability – the practice of designing the product to deteriorate quickly by using inferior materials and components for example

Prevention of repair – the use of components that make it difficult to repair such as Apple's "tamper-resistant" pentalobe screws, or by making spare parts expensive or difficult to get hold of.

Perceived obsolescence – designers changing the style of a product to make the consumers wanting to purchase a newer model for fashionable reasons.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 1c
2	3-4	Good evaluation regarding how the use of planned obsolescence affects the consumer and the manufacturer. A sound discussion which appraises and/or makes judgements. Generally well-considered, relevant issues used as a context for the discussion.	2	Applies a sound knowledge and understanding of technical principles to the context planned obsolescence. Generally well-considered, relevant issues identified.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited evaluation regarding how the use of planned obsolescence affects the consumer and the manufacturer. Little evidence of appraising or making judgements.	1	Applies a basic knowledge and understanding of technical principles to the context planned obsolescence.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 8

The LED bulb lamp made from natural hardwood below is made as a one-off prototype.

Discuss how the manufacturer could make the LED bulb lamp using batch production tools and processes.

	Science	Maths		AO3		AO4					Total
				2a		2a	2b	2c			
				6				3			9

Candidates should provide evidence of logical reasoning or deconstructing information and applying this to be awarded up to 9 marks based on:

Indicative content:

Batch Production

A specific number of products produces can be a batch of 10 or 5,000.

Advantages

Expensive to set up production lines and equipment. End product will be cheaper to sell.

A good method if the item goes out of fashion or sells poorly, then production can stop. Can change production to suit market demands.

Disadvantages.

Company needs to be flexible to adapt to different types of product batches.

Initial set up of equipment can be expensive. Usually more expensive than mass production.

Stages of manufacture:

Primary processing. Buying raw material, forward ordering, Processing of materials

Secondary Processing. Assembly of components, Finishing

When making several identical product or parts, jigs, formers, templates, patterns and moulds are used to ensure the parts are all the same. Batch Production Tools relevant for this product:

A jig can be used to make sure that parts are made exactly the same, without the need for marking out. For example, when drilling through a block of wood with two holes in, it will make sure that the holes are drilled in the same place in each component, such as the holes drilled to house the LED bulb and the electrical wire.

Template

A template is something that you can draw around to mark an irregular shape onto material, so that it can be cut or shaped such as the base of the lamp.

Standardised components – To reduce costs, staffing, machinery companies do not manufacture all of their components for their products. They buy in standardised parts or part assembled components to be assembled on site to create the finished product. These items can range from nuts & bolts, screws, springs or circuit boards. They have to be sure that these components are of a high quality. They will ensure that the companies that manufacture these components have some Quality Control systems in place during manufacturing. Products are safe, within tolerance [Correct size, shape, weight etc.] or they would not fit onto their product. Standard sizes e.g. metric, thread etc.

Stock Forms of Materials

Natural wood is available in standard stock form in different lengths. The manufacturer could ensure that the product is sized to match common stock forms to reduce the amount of planning and thicknessing.

During manufacture, they would also try to ensure minimal wastage of materials.

Quality Control

Quality Control can be carried out throughout the manufacturing process. As the product is made it is tested to see if it works, if it is within tolerance [correct size], if it has been assembled correctly, and has no surface defects.

These steps are in place to make sure that the final product will be of a high quality and therefore ensures customer satisfaction with a product that will work well. Every electrical product will have to be tested due to safety issues.

Credit any other appropriate response.

Band	Marks	AO3 2a	Marks	AO4 2c
3	5-6	Excellent discussion of how batch production tools and processes can be used to manufacture the product. A thorough discussion, which deconstructs information and demonstrates logical connections and reasoning throughout. Well-considered, relevant examples used to support the discussion.	3	Applies a thorough knowledge and understanding of designing and making principles to illustrate, with well-considered, relevant examples, of batch production tools and processes.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	3-4	Good discussion of how batch production tools and processes can be used to manufacture the product. A generally sound discussion, which deconstructs information and provides adequate connections and reasoning throughout. Generally well-considered, relevant examples used to support the discussion.	2	Applies a generally sound knowledge and understanding of designing and making principles to illustrate, with generally well-considered examples, of batch production tools and processes.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited discussion of how batch production tools and processes can be used to manufacture the product. Little evidence of deconstructing information and limited connections are made. Few examples used to support the discussion.	1	Applies a basic knowledge and understanding of designing and making principles to partly demonstrate, with limited exemplification, of batch production tools and processes.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 9

The security light below uses solar panels as an alternative to mains electricity.

Evaluate the advantages and disadvantages of using solar panels rather than mains electricity for this product.

	Science	Maths		AO3		AO4					Total
				2b		2a	2b	2c			
	✓			6			3				9

Candidates should provide evidence of either appraisal and/or making judgements and applying this to be awarded up to 9 marks based on:

Advantages of solar panel lighting products

Solar lights are the greener option because they do not run on electricity and therefore do not require standard electrical power.

Safer than traditional electric current, no initial wiring required to install the light.

Solar panels used on products are continually improving to give better storage into the battery to emit light at better intensities and for longer periods of time.

Solar power is pollution free and reduces the dependence on fossil fuels commonly used for electrical products wired into the grid.

Solar panels are clean power that is available every day of the year; even cloudy days can produce some power.

Use batteries to store power during the day to use at night when the light will be required to be used. Lights using electricity requires no battery. More components needed in solar lights therefore increasing the chances of component failure.

Very low maintenance, solar panels have a long life.

Solar lighting does not cost to run, lighting that runs on DC power costs to use.

Solar lights provide a gentle light since the power is limited; LEDs operate more efficiently off 12VDC power than AC power.

Solar lights are not restricted to where they can be placed compared to electrical lighting, which requires reasonable access to the wiring in the home.

A qualified electrician is required to wire in a traditional electrical light; a solar light requires limited skills and experience to mount into position.

Disadvantages of solar panel lighting products

The geographical area may have an impact on how effective the light works particularly in countries with limited daylight hours. Winter months in the UK will reduce the performance of the light as less daylight hours are available to store energy in the battery.

Cloudy days will also reduce the effectiveness of the battery to store energy.

Colour of solar panels can be too blue. The major strength of main powered security lights is their consistent, high quality light output. Because they have a steady supply of electricity, the light output remains the same over time. Because mains powered lights receive more power from the mains as opposed to batteries, they produce a much higher light output, illuminating dark areas more effectively.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 2c
3	5-6	Excellent evaluation of the advantages and disadvantages of using solar panels rather than mains electricity for this product. A thorough discussion that appraises and/or makes judgments. Well-considered, relevant wider issues used as a context for the discussion.	3	Applies a thorough knowledge and understanding of technical principles to the context of solar lighting and mains electrical lighting. Well-considered, relevant wider issues identified.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	3-4	Good evaluation of the advantages and disadvantages of using solar panels rather than mains electricity for this product. A generally sound discussion that appraises and/or makes judgments. Generally well-considered, relevant issues used as a context for the discussion.	2	Applies a generally sound knowledge and understanding of technical principles to the context of solar lighting and mains electrical lighting. Generally well-considered, relevant issues identified.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited evaluation of the advantages and disadvantages of using solar panels rather than mains electricity for this product. Little evidence of appraising or making judgments.	1	Applies a basic knowledge and understanding of technical principles to the context of solar lighting and mains electrical lighting.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 10

Modern manufactured boards have had a significant impact on the design of home furniture.

Discuss the advantages and disadvantages of using manufactured boards in modern home furniture.

	Science	Maths		AO3		AO4				Total
						1b	1c	2b	2c	
	✓					4		8		12

Candidates should demonstrate knowledge and understanding of technical principles and designing and making principles and apply this to be awarded up to 12 marks based on:

Indicative content:

- Manufactured boards comprise a range of sheet materials produced by pressing and bonding together wood particles, fibres or veneers to achieve particular characteristics – and to create a use for what would otherwise be discarded as waste. This is substantially better for the environment.
- Manufactured boards are cheaper than solid timber therefore reducing the costs to the manufacturer and the consumer
- Manufactured boards can be easily cut drilled, routed, glued and fastened, therefore making it ideal for flat pack construction and housing knock down fittings.

Examples of Manufactured boards

- Blockboard – This is built up with a core of softwood strips bonded together with adhesive and covered with a sheet of plywood on either side. Used as a building material and for furniture manufacture including fitted kitchens / bedrooms.
- Chipboard – This is made up of small chips of wood bonded together with resin and formed into sheets by compression. It is not as strong as plywood and block board but it is not expensive. It is a very cheap material and is used to make kitchen worktops and carcasses (cupboard shells) where it is laminated with a melamine layer to give it a decorative and hardwearing finish
- Hardboard – This is made from wood fibres that have been pulped. The pulp is put under pressure until the fibres bond to produce a tough board that is smooth on one side and rough on the other. It is not as strong as the other boards. Often used as the back of cupboards or shelving units.
- Medium Density Fibreboard (MDF) – A quality board, relatively cheap. This board is composed of fine wood dust and resin pressed into a board. This material can be worked, shaped and machined easily. Paint can be applied to it without the need for an undercoat or primer. Commonly used with a veneer of real wood to improve the surface quality in household furniture
- Plywood – This is made from veneers (plies) of timber with each grain layer being at right angles to each other and bonded together by resin and pressure. Often used in household furniture and is seen as higher quality than other manufactured boards.
- High Density Chipboard is a rigid board with a relatively smooth surface [1] that is ideal for applying veneer as it requires a smooth surface. [1]

Advantages and Disadvantages

Manufactured boards can come in very wide sheets, which is good for large pieces of furniture without having to join pieces together.

Many manufactured boards have good dimensional stability.

Manufactured boards surfaces can take many finishes and can be painted easily. Many can be veneered to add to the properties and aesthetic qualities of the product.

Plywood is easy to bend over formers for laminating and making complex shapes.

Manufactured boards are better for the environment.

Manufactured boards are cheaper than natural timber cutting costs to the consumer and the manufacturer.

Many manufactured boards edges require facing.

Repair and maintenance can be difficult.

Thin sheets of manufactured boards need support to stop them from bending.

Cutting and sanding of some manufactured boards can create hazardous dust.

Credit any other appropriate response.

Band	Marks	AO4 1b and 1c	Marks	AO4 2b and 2c
3	6-8	Demonstrates and applies a thorough knowledge and understanding of technical principles related to the advantages and disadvantages of using manufactured boards in modern home furniture Well-considered, relevant wider issues identified.	4	Demonstrates and applies a thorough knowledge and understanding of designing and making principles related to manufactured boards, drawing upon well-considered, relevant examples.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	3-5	Demonstrates and applies a generally sound knowledge and understanding of the advantages and disadvantages of using manufactured boards in modern home furniture Generally well-considered, relevant issues identified.	3	Demonstrates and applies a generally sound knowledge and understanding of designing and making principles related to manufactured boards. Generally well-considered examples are provided.
		There is a line of reasoning which is generally coherent, mainly relevant, and with some evidence and structure.		
1	1-2	Demonstrates and applies a basic knowledge and understanding of technical principles related to the advantages and disadvantages of using manufactured boards in modern home furniture. Few issues are identified.	1	Demonstrates and applies a basic knowledge and understanding of designing and making principles related to manufactured boards. Few examples are provided.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		