



GCE AS MARKING SCHEME

SUMMER 2025

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

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

EDUQAS GCE AS DESIGN AND TECHNOLOGY – COMPONENT 1

PRODUCT DESIGN

SUMMER 2025 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 images below show kitchenware made from melamine formaldehyde.

- (a) Describe **two** properties of melamine formaldehyde that make it an appropriate material for the kitchenware.
- (b) Explain **two** different functional qualities to be considered when designing the kitchenware.

Manufacturers often use primary research to find out consumers' opinions.

- (c) Explain **one** primary research method a manufacturer may use to find out consumer opinions when designing kitchenware.

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

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

Award 1 mark for each property of melamine formaldehyde that makes it appropriate for the kitchenware and 1 mark for the justification up to a total of 4 marks.

- Melamine Formaldehyde has good hardness properties [1] and will therefore be suitable resist scratching and abrasion from everyday wear [1].
- Melamine Formaldehyde is shatterproof [1] that is ideal if dropped in the kitchen. [1]
- Melamine Formaldehyde has a smooth surface [1] therefore it will have a high-quality finish when printed on [1]
- Melamine Formaldehyde has good stain and chemical resistance [1] making it suitable for cleaning with a variety of chemicals required during washing/dishwasher [1]

Credit any other appropriate response.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
1. (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 comment up to a total of 4 marks.

- The product's ease for cleaning needs to be considered [1] to facilitate different cleaning products [1].
- The stack ability of the product needs to be considered [1] it increases the products storage facilities [1].
- The ease of printing needs to be considered [1] to ensure that a range of aesthetic images can be produced to meet the needs of the consumer [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]
- Dividing up sections of plate / for different fruits / vegetables / dips etc.

Credit any other appropriate response. (Avoid credit to repeat responses from 1(a))

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

Candidates should demonstrate knowledge and are awarded up to 2 marks

Award 1 mark for the reason and 1 mark for the justification up to a total of 2 marks.

Use of questionnaires [1] to establish consumers' needs and wants [1]

Use of focus groups [1] to gain feedback on ideas [1]

Examining products made by other companies [1] to understand what is already on the market.

Interview/discussion with target market [1] to establish consumers' needs and wants [1]

Credit any other appropriate response.

Question 2

The lamp shown below is made from anodised aluminium and comes with the information shown.

- (a) Explain **one** reason why anodising is a suitable finish for the lamp.
- (b) Discuss what information the symbols on the labels provide for the consumer.
- (c) Each lamp retails at £19.99. The manufacturer makes 23% profit on each lamp after manufacturing and distribution costs.
 - (i) Calculate the cost to the manufacturer of each lamp before profit.
Show all calculations
 - (ii) Examine the six-month sales data for a range of different colour lamps. Calculate the percentage sales of bronze and silver lamps against overall sales between March to May
Show all calculations
 - (iii) The lamp retails at £19.99 in the UK market. The manufacturer wishes to sell the product in the EU market. The current exchange rate = £1 to 1.20 Euros. Calculate the sale cost of one lamp for the EU market
Show all calculations

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

Candidates should demonstrate application of knowledge and understanding and are awarded up to 2 marks.

1 mark for a naming a reason why anodising is a suitable finish and 1 mark for a justification or supporting reason up to a total of 2 marks

Anodising provides a protective coating [1] providing the product with durability [1]
 Anodising can come in a variety of colours [1] providing the consumer with more choice [1]
 Anodising provides ease of maintenance [1] making it ideal for the consumer to look after the product [1]

Credit any other appropriate response.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
2. (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 comment up to a total of 4 marks.

- The product has a CE mark [1] which provides the consumer with reassurance that the product has been tested to certain standards including electrical safety [1].
- The product has a restriction to hazardous substances [1] meaning that the product has to meet guidelines regulating hazardous chemicals in electrical equipment [1].
- The product has a crossed-out wheelie bin symbol [1] to remind the consumer that electrical equipment must be taken to separate collection at the end of its working life [1].

Credit any other appropriate response.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
2. (c) (i)		2					2					2

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

$$£19.99 \times 0.77 = 15.3923$$

1 mark

$$\text{Rounded} = £15.39$$

1 mark

Credit any other appropriate mathematical response.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
2. (c) (ii)		3					3					3

Candidates should demonstrate understanding and be awarded up to 3 marks based on:

Overall sales of Lamps between March – May

Bronze $31+72+21 = 124$

Silver $49+71+62 = 182$

Gold $62+51+71 = 184$

White $56+82+35 = 173$

Black $35+49+89 = 173$

Total Sales = 836

1 mark

Bronze + Silver Lamp sales combined

$124+182 = 306$

1 mark

Percentage share of bronze and silver lamps

$(306 * 100) / 836 = 36.6\%$

1 mark

Credit any other appropriate mathematical response.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
2. (c) (iii)		2					2					2

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

Conversion rate: £1 = 1.2 Euros

Lamp Cost £19.99

$£19.99 * 1.2 = 23.988$ or 23.99 Euros

2 marks

Question 3

Study the images shown of an outdoor planter.

- Using notes and diagrams, describe how the plant pot insert has been manufactured using injection moulding.
- Explain how the properties of high-density polyethylene make it suitable for the plant pot inserts.

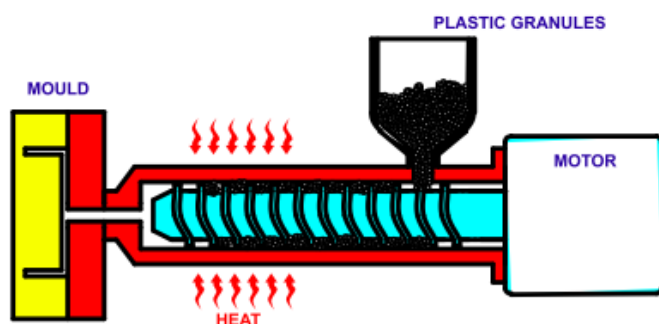
The outer casing of the planter is made from a PVC rattan weave.

- Explain how additives can be applied to PVC to improve the properties and function of the outer casing of the planter.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
3. (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.



- Granulated plastic powder is poured into the hopper, which stores them until they are required.
- A heater heats up the tube and when it reaches the required high temperature a screw thread [Archimedes Screw] starts turning as a result of the motor. This pushes the powdered plastic along the screw towards the mould.
- The liquid is forced [injected] into a mould where it cools into the shape
- The mould then opens, and the unit is removed.

Credit any other appropriate response.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
3. (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.

High density polyethylene is waterproof [1] making it ideal for the product as it is an outdoor product. [1].

High Density Polyethylene has good hardness [1] and therefore making it more resistant to wear and tear and abrasion [1]

High density polyethylene is self-finished [1] therefore no other finish is required on the product to make it usable [1]

High density polyethylene is a thermoforming polymer with a low melting point [1] therefore making it easier to injection mould into complex shapes. [1]

Credit any other appropriate response.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
3. (c)							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.

Pigments can be added to the polymer [1] Ensuring the manufacturer can produce a range of products in different colours [1]

Plasticisers can be added to the polymer [1] to ensure the polymer has the required softness for moulding processes [1]

UV protection can be added to the polymer [1] to ensure that the product does not degrade quickly whilst being outside [1] this would make the product UPVC.

Chemical resistance can be added to the polymer [1] to ensure the product does not degrade with chemical use such as bleach and washing detergents [1]

Credit any other appropriate response.

Question 4

A designer has rapid prototyped a design for a canister to hold small drill bits.

Examine the 3D Printed canister and 3D and 2D CAD drawing below

- (a) (i) Find the volume of the lid in millimetres (mm) rounded to one decimal place.
Show all calculations.

The manufacturer wishes to place a sticker around the cannister with company and product information.

Below is a sample of the sticker and the cannister measurements.

- (ii) Calculate the surface area of the cannister so the manufacturer can make the correct size sticker to go around it. Round your answer to one decimal place.
Show all calculations.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
4. (a) (i)		✓						5				5

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

Volume of large cylinder

$$V = \pi r^2 h$$

$$\text{Diameter of large cylinder} = 30\text{mm}/2 = 15\text{mm}$$

$$V = \pi * [15\text{mm}^2] * 5\text{mm}$$

$$V = \pi * 225 * 5\text{mm}$$

$$V = \pi * 1125\text{mm}$$

1 mark

$$V = 3534.291735288517\text{mm}$$

1 mark

Volume of smaller cylinder

$$V = \pi r^2 h$$

$$V = \pi * [12\text{mm}^2] * 3\text{mm}$$

$$V = \pi * 144\text{mm} * 3\text{mm}$$

$$V = \pi * 432$$

1 mark

$$V = 1357.168026350791$$

1 mark

Add the two cylinders together
 $3534.291735288517 + 1357.168026350791$
 $= 4891.459761639308^3$

Rounded to one decimal place
 $= 4891.5 \text{ mm}^3$

1 mark

Credit any other appropriate mathematical response. Allow for rounding errors and using π or 3.142 on the calculator.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
4. (a) (ii)		✓						3				3

Candidates should demonstrate knowledge and understanding and be awarded up to 3 marks based on:

Formula for curved surface area of a cylinder : $2\pi r h$
 $= 2 \pi * (30/2)$
 $= 2 \pi * (15)$
 $= 94.2477796076938$

1 mark

Include height calculation
 $= 94.2477796076938 * 50$
 4712.38898038469

1 mark

Answer = rounded to one decimal place.
 4712.4 mm^2

1 mark

Credit any other appropriate mathematical response. Allow for rounding errors and using π or 3.142 on the calculator.

Accept any appropriate mathematical process.

Question 5

Examine the image below of duplex board packaging for fresh cakes.

- (a) Describe **two** reasons why duplex board is a suitable material for this product.
- (b) Explain why die-cutting is a suitable method to manufacture the duplex board packaging.

Below is a vacuum formed tray for a box of chocolates made from high impact polystyrene.

- (c) Explain what features are required to make a successful former for the tray.

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

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

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

Duplex board is a relatively cheap material [1] reducing the price of product packaging for the manufacturer and the consumer [1]

Duplex board is stiff [1] providing rigidity and protection for the contents of the packaging [1]

Duplex board has a wax coating on the outside/inside of the packaging [1], to ensure that moisture does not ruin the contents of the packaging/prevents the cake from drying out [1]

Duplex board can be printed on easily [1] enabling the manufacturer to improve the packaging to entice consumers and place vital information such as Best-Before-Dates [1]

Credit any other appropriate response.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
5. (b)							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.

Die cutting is a good process at cutting out complex shapes all at once [1] this speeds up manufacturing [1]

Die cutting can crease board at the same time as cutting [1] making it ideal to produce a box from a net [1]

Die cutting can be automated [1] removing human error in manufacturing [1]

Credit any other appropriate response.

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

Candidates should demonstrate understanding and be awarded 4 marks.

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

Indicative content

The former requires a smooth surface [1] to ensure that the mould releases correctly during manufacture.

Formers tend to be made from cast/machined aluminium [1] to ensure durability of the mould in mass production [1]

Draft Angles are present in the design of the former recommended 1° for every 20mm of height [1] to ease removal of the formed plastic part from the former. [1]

No undercuts are present on the former [1] to ensure that the plastic does not get stuck on the mould during manufacture [1]

Formers have rounded edges [1] to ensure the plastic doesn't get stretched/reduce webbing [1]

Air holes are used in crevices [1] to ensure that air doesn't get trapped/and to increase accuracy of the former [1]

Credit any other appropriate response.

Question 6

Designers need to consider differences between cultures and markets when designing products.

Discuss the factors that a designer may consider when designing products for different cultures.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
6									6			6

Candidates should demonstrate understanding and are awarded up to 6 marks based on:

Designers need to consider the social, moral, ethical, and cultural factors as part of responsible design. This will ensure that designers can design and market products internationally for different markets.

Indicative content:

Candidates may consider range of factors for consideration:

Functional design:

Different cultures have different habits and customs which require thinking carefully about the functional aspects of design, for example, western society sits on chairs for dining, whereas in Japan the custom is to sit on the floor, hence the removal of legs for dining room furniture. Early mobile phone was designed to aid functionality for different cultures. For example, many Western societies tend to text with both hands, whereas in Japan many people text with one hand. This is primarily because in Japan there is a large subway community culture, meaning that people were often holding onto the subway handles, therefore the habit and need to text one handed, this meant that mobile phones in Japan were designed with one hand texting in mind.

Ergonomics and Anthropometrics needs to be considered for different cultures, games controllers tend to be smaller for Asian markets and larger for western cultures due to the difference of hand size.

Design and layout:

Cultural issues affect the layout and presentation of information. Western society reads from left to right, whereas Arabic and Hebrew read from right to left and older forms of Chinese read vertically. This will impact the way in which information and branding may appear on products and the way in which instruction manuals are produced.

Spreadsheet data and graphs and collated pictures are traditionally arranged to flow from right to left, whereas in the Middle East they flow left to right.

Colour

Colour has an impact on product design across different cultures. Whereas red in western societies are associated in colour psychology terms as danger or warning, in far eastern and Indian culture it is associated with wealth and good fortune. This may mean that when products sold in different countries, the designer may need to consider the meaning of colours for each individual culture.

Religion plays a key part in different cultures, in Christianity orange is associated with gluttony, radiance and God's presence, whereas in Buddhism orange is associated with wisdom. The designer must consider the association of products in terms of religion to avoid offence.

Materials

The materials used in products can cause offence in different cultures, for example when the new £5 polymer bank note was first introduced, it contained tallow [a substance derived from animal fat]. This caused upset to many Hindus, Sikhs, vegetarians and vegans within the UK community.

Band	Marks	AO4 2a & 2b
2	4-6	Good discussion of the factors that a designer may consider when designing products for different cultures. Generally well-considered and relevant examples used as a context for the discussion.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.
1	1-3	Limited discussion of the factors that a designer may consider when designing products for different cultures. Few examples are used as a context for the discussion.
		There is limited evidence of relevant examples or structure.
	0	No response or work that is worthy of a mark.

Credit any other appropriate response.

Question 7

Examine the gaming mouse made from polypropylene pictured below.

- (a) Analyse the physical and mechanical properties of polypropylene that make it suitable for the gaming mouse.
- (b) Evaluate how ergonomic and anthropometric considerations impact on the design of the gaming mouse.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
7. (a)				5								5

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 5 marks.

Candidates must discuss both mechanical and physical properties to gain Band 3.

Indicative content

Mechanical Properties of Polypropylene:

Polypropylene has a good strength to weight ratio, due to the properties of toughness and hardness [mechanical properties] compared to its low density [physical property] that makes it lightweight. This makes the product more robust, hardwearing, and long lasting but retains the lightness needed for the user.

Mechanical properties – Polypropylene has hardness and toughness that adds to the durability of the product.

Polypropylene is a thermoforming polymer with a lower melting point [physical property], this results in the product being easy to mould into complex shapes such as through injection moulding. The structure of Polypropylene is not cross linked therefore it can be remoulded and recycled at the end of the product life making it more sustainable.

Polypropylene is a semi-crystalline thermoforming polymer which is ideal for opaque colours, it is also easy to add pigments and colour at the manufacturing stage providing a larger choice of colours for the consumer [physical property].

Polypropylene is an insulator adding extra protection to the user from the electronics housed in the gaming mouse. [Physical Property].

Credit any other appropriate response.

Band	Marks	AO3 2a
3	4-5	Excellent analysis of the physical and mechanical properties of polypropylene. A sound discussion which deconstructs information and provides adequate connections and reasoning. Well-considered, relevant issues used as a context for the discussion.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.
2	3	Good analysis of the physical and mechanical properties of polypropylene. A sound discussion which deconstructs information and provides adequate connections and reasoning. Generally well-considered, relevant issues used as a context for the discussion. There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.
1	1-2	There is limited evidence of relevant examples or structure.
	0	No response or work that is worthy of a mark

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
7. (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:

- When designing a product, designers consider human senses including sight, smell, touch, comfort, sound and temperature.
- Ergonomics is an applied science concerned with designing and arranging things people use so that the people and things interact most efficiently and safely. Can also be called biotechnology, human engineering, human factors
- If a product is ergonomically designed the chances are that it will be a successful product. The user will be able to use the product comfortably.
- To ensure that products are comfortable and easy to use designers use anthropometric data to make sure that the product is suitable for human use. Anthropometrics is the Science of collecting statistical data about body measurements. Data is collected for adults and children. Some people are outside of the average range of body measurements. These are considered to be the 5th and 95th percentile, people who are bigger or smaller than average. The designer invariably designs to the average person.

Candidates could discuss:

- The extended use of a gaming mouse can result in repetitive strain injuries [RSI] which are muscular disorders that can occur in wrists and fingers from being in an uncomfortable position for too long. The following factors must be considered by the designer to minimise health and safety for the user whilst maintaining optimal and efficient use of the mouse.
- The mouse should be contoured, and edges should be rounded to increase the comfort for the user. A better ergonomically designed mouse will ensure the user can reach the buttons and have a comfortable grip. Most have shapes that mould to the hand.
- The material should not cause sliding or sweating from the hand.
- The ideal situation is to maximise the users comfort both short term and long term, whilst increasing the users flexibility and dexterity so movement is not impeded.
- Common colours are often used to standardise across different mice.
- The gaming mouse controls must be customisable to ensure that the user can create the best configuration for gameplay.
- The use of trackballs allows the user to maintain a steady grip with none or little arm movement therefore reducing the risk of RSI.
- A vertical mouse are held upright like a joystick, which users can find more natural than a palm down grip which may reduce the risk of RSI.
- The buttons need to be large enough in width/diameter to facilitate the 95th percentile of users as Users with larger fingers will not be able to press the buttons accurately if the buttons are too small for their fingers.
- The distance between the buttons should be large enough that they can be pressed individually by the 95th percentile of users, users with larger fingers might accidentally hit multiple buttons if they are spaced too close to each other.
- The affordance [Affordance: The visual cues and feedback a device provides to allow the user to intuitively know how to use it as intended] of the controller should provide the user with ample information to use the controller as it is intended, this allows the controller to be used in a proper manner and to provide the user with a better experience.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 1c
2	3-4	Good evaluation of how ergonomic and anthropometric considerations impact on the design of the gaming mouse. A sound discussion which appraises and/or makes judgements about how the use of materials affect sustainability. Generally well-considered, relevant issues used as a context for the discussion.	2	Applies a sound knowledge and understanding of technical principles. 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 how ergonomic and anthropometric considerations impact on the design of the gaming mouse. Little evidence of appraising or making judgements about how the use of materials affect sustainability.	1	Applies a basic knowledge and understanding of technical principles.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 8

Examine the examples of knock down fittings below, commonly used in flat pack furniture.

Analyse the advantages and disadvantages of using knock down fittings in flat pack furniture to the consumer and manufacturer.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
8				5					4			9

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

Candidates could discuss:

Advantages for the Manufacturer of knock down fittings:

Knock down fittings are standardised parts that can be used across a range of products. This therefore becomes more cost effective for the manufacturer and aids the use of standardised and customisable designs.

The use of standardised parts can reduce the manufacturing costs as bespoke parts/joints for the design do not have to be made especially for products.

Knock down fittings enable the consumer to build their own flat pack furniture, this means the manufacturer can reduce costs through construction, storage and transport and distribution.

Disadvantages for the Manufacturer of knock down fittings:

Knock down fittings are often supplied as standardised parts from another company this increases the need for the manufacturer to conduct quality assurance and quality control on parts coming in to ensure they meet the required standards. This can increase the costs. Manufacturers who use Just in Time principles may have issues with production flow if a supplier of knock down fittings sends a faulty or incorrect batch, this increases lead times and inevitably affects profits.

Advantages for the consumer of knock down fittings:

Knock down fittings are commonly used across flatpack DIY furniture which provides the consumer with customisable choice across a range of products.

Products that use knock down fittings require a small number of basic tools such as a screwdriver, hammer, and drill making it easier to assemble in the home.

Products that use knock down fittings can be assembled and reassembled easily, the consumer would be able to move the product around the home or when moving home easily.

Replacement parts are easy for the consumer to purchase as they are readily available in a range of DIY shops.

The use of knock down fittings means that the product can be sold as a flat pack product and assembled at home which makes it easier to transport the product from home to the store

Disadvantages for the consumer of knock down fittings:

Knock down fittings are primarily used on veneered manufactured board. Chipboard can start to disintegrate over time if the product is assembled and disassembled leading to the knock down fittings being loose.

Credit any other appropriate response.

Band	Marks	AO3 2a	Marks	AO4 2a
3	4-5	Excellent analysis of the advantages and disadvantages of using knock down fittings in flat pack DIY furniture to the consumer and manufacturer. A thorough discussion, which deconstructs information and demonstrates logical connections and reasoning throughout. Well-considered, relevant examples used to support the discussion.	3-4	Applies a thorough knowledge and understanding of designing and making principles to illustrate, with well-considered, relevant examples of the advantages and disadvantages of using knock down fittings in flat pack DIY furniture to the consumer and manufacturer.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	2-3	Good analysis of the advantages and disadvantages of using knock down fittings in flat pack DIY furniture to the consumer and manufacturer. 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 the advantages and disadvantages of using knock down fittings in flat pack DIY furniture to the consumer and manufacturer.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1	Limited analysis of the advantages and disadvantages of using knock down fittings in flat pack DIY furniture to the consumer and manufacturer. 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 the advantages and disadvantages of using knock down fittings in flat pack DIY furniture to the consumer and manufacturer.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 9

The coffee machine below is an example of a product that has been mass produced.

Evaluate the use of ICT and automation when mass producing products.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
9	✓				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:

Indicative content

Candidates must consider how to balance off the benefits to the manufacturer of the use of ICT and automation, whilst acknowledging the complexity and demands of setting up and running these systems.

Computer Integrated Manufacture [CIM]

The manufacturer will use computers for planning and control of the production process. This would manifest itself at all stages of the production process: Planning, research, design, testing, accounting, inventory control and distribution. This would involve a high level of automation relying heavily on feedback from sensors and data streams.

Data Analysis

Regular checks within an integrated manufacturing system will provide constant data feedback [monitoring performance]. This will result in high expenditure for the manufacturer in initial setting up costs and will require skilled employees to plan and implement the various methods to collect data and analyse. Once in place, the benefits to the manufacturer will include eliminating downtime, increasing productivity and therefore profit margins. The information also allows the manufacturer to make improvements to the production processes.

Integrated computer systems

Production can be controlled and monitored through consumer sales and demand using Electronic Point of Sale EPOS.

Packing and Distribution can be streamlined to be more effective giving the manufacturer and the retailer accurate lead times for orders and delivery. Using RIFD tags or barcodes orders and specific parts can be ordered to arrive on time and can be tracked in real time. They can also be used to reorder parts from suppliers as needed and promotes lean production approaches. However, manufacturers are often reliant on other suppliers, and if parts do not arrive in time, then this can cause issues with production and lead times which can impact negatively on consumers.

Integrated computer systems from retailer to manufacturer supports Just in Time [JIT] principles of manufacturing and enables the manufacturer to use flexible manufacturing systems and Quick Response Manufacturing [QRM]. This will make them more efficient and competitive, although if any part of the system goes down, this can lead to issues relating to under production.

Flexible manufacturing systems can adapt to changes in material, product and scale of production and responds quickly to market demands, Computer Numerical Control machines [CNC] can be quickly programmed to adapt a product with the use of multi-functional tools and quick release dies with little downtime to production.

Storage areas within the manufacturing plant use computer systems to reduce excess inventory. Manufacturers can also use Automated guided vehicles [AVGs] to collect stock and distribute them more effectively.

The continual use of IT and automation results in a less low skilled workforce and the need for a more skilled workforce who can use CNC machines, and program machines effectively.

Computer Aided Quality Control

Testing of materials prior to manufacture [computer aided] can ensure quality and that the material meets the intended specification. Destructive testing of materials creates waste for the manufacturer, but this is balanced by the need to ensure consumer safety and meet legislative requirements. Non-destructive testing is less wasteful such as liquid penetration, magnetic metal testing, the use of light, x-rays and ultrasonic sound. These methods rely heavily on the use of computers to give effective data and feedback.

Quality control throughout manufacture

Quality control of end product will ensure that the product is at the quality for the consumer. The use of Computers ensures that the manufacturer avoids human error, that the inspection and testing is efficient and accurate.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 1c
3	5-6	Excellent evaluation of the use of ICT and automation in mass production techniques. 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 related to ICT and automation in mass production techniques. 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 use of ICT and automation in mass production techniques. 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 related to ICT and automation in mass production techniques. 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 use of ICT and automation in mass production techniques. Little evidence of appraising or making judgments.	1	Applies a basic knowledge and understanding of technical principles related to ICT and automation in mass production techniques.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark.		

Question 10

Hardwoods, softwoods and regenerated materials are commonly used by construction companies for many applications when building homes.

Using a life cycle analysis, discuss the impact of using different hardwoods, softwoods and regenerated materials when building homes.

Q	Science	Maths		AO3		AO4						Total
				2a	2b	1a	1b	1c	2a	2b	2c	
10	✓							6			6	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:

Candidates should exemplify their response naming specific timbers and regenerated boards used in the building of homes: Soffit Boards – pine, cedar; Timber Frame -pine, oak; Front Door – pine, oak; Timber Internal Cladding – plywood, chipboard; Rafters – pine, oak; Timber external cladding – larch, cedar, pine; Window Frames – pine, oak, cedar, beech; Window Sills – pine, oak, beech; Wooden Flooring: oak, pine, beech, ash, laminated man-made board, Kitchen units: man-made board/natural wood – laminated/veneered; kitchen worksurfaces – chipboard/natural wood/melamine formaldehyde – veneered.

Candidates may also discuss timber/man-made board used when constructing the house such as shatter ply, chipboard to build moulds for cement.

Design

The design of the product has an impact on its life cycle and environmental issues.

Building regulations dictate the construction of housing and therefore there is less choice for the construction company to use.

Many materials are decided on due to their properties, for example cedar and larch contains natural oils which protect the wood from moisture and damage. Choosing the right material can improve durability making them last longer and therefore less impact on the environment as they won't need replacing as quick.

The builder may choose cheaper materials [building regulations allowed] to reduce the costs and increase profit. However, these would have a shorter life being less durable and therefore would need replacing therefore increasing the impact on the environment.

Materials Extraction and Processing

Hardwoods and softwoods are renewable resources although hardwoods take much longer to grow whereas softwoods tend to grow fast and can often be grown using sustainable forests. The Forestry Stewardship Council [FSC] can be used to ensure that the source material has been grown/harvested in a sustainable way and managed forests.

The clearing of forests for timber has an impact on habitats and can lead to flooding. The use of tropical hardwoods is leading to a significant reduction in areas such as the rainforest which in turn is having an impact on photosynthesis, increasing carbon dioxide levels and contributing to global warming.

Many composite materials such as MDF, Plywood/ blockboard commonly used in building construction are usually bonded using glues/resins such as Urea Formaldehyde which makes them less sustainable or harder to recycle. The cellulosic fibres of many composite materials can be made using recycled materials which has a better impact on the environment.

Kiln Seasoning is faster but requires more energy than natural/air seasoning. The advantages of kiln seasoning is that accurate water content can be achieved, it kills bugs and fungus whereas natural seasoning is harder to control accurately and bugs and fungus may survive, although the end of the planks can split resulting in more wastage.

Conversion of timber can have an impact on the use and wastage of timber, whilst quarter sawing provides more stable timber, it is a longer process, takes more energy, and is more wasteful. Through and through [plain or slab sawing is quicker, takes less energy, and is less wasteful; although the planks are prone to shrinkage and defects such as cupping and twisting resulting in more waste.

Packaging & Transportation

The choice of materials for building homes can have a detrimental effect on the environment due to transportation. The use of many softwoods and northern European hardwoods has less distance to travel when building homes in the UK market, the use of tropical hardwoods results in timber travelling large distances, using fossil fuels, and contributing to CO2 emissions and global warming.

Use

The way in which products are used can detrimentally affect the environment. However, many timber products in the building of homes have a limited negative impact on the environment. Owners may need to protect timber products such as window frames and doors by applying protective coating, therefore increasing durability and protection, and making it last longer. The application of different finishes such as varnish and oil-based paints contributes negatively to the environment.

End of Life

Many of the timber building products for the housing industry are durable and designed to last. Doors and window frames have the least durability and may need replacing over time. Many of the timber products can be recycled and then used in the construction of composite materials such as MDF, chipboard, blockboard. Consumer habits are important to ensure that recycling is undertaken otherwise they may end up in landfill. Most natural timbers will decompose over time in landfill due to its cellulosic nature. Many composite materials, contain glues and resins which are less decomposable, many veneered chipboards with melamine formaldehyde worksurfaces are harder to recycle as it is harder to separate the polymer from the timber.

Circular Economy

Candidates may refer to circular economy approaches to the use and management of timber products, where consideration is given at all stages of the life cycle of a product to promote sustainability. Consideration may be given to the management of renewable sources.

Credit any other appropriate response.

Band	Marks	AO4 1b and 1c	Marks	AO4 2b and 2c
3	4-6	Demonstrates and applies a thorough knowledge and understanding of technical principles related to the suitability of using different hardwoods, softwoods, and regenerated boards in the context of a life cycle analysis. Well-considered, relevant wider issues identified.	5-6	Demonstrates and applies a thorough knowledge and understanding of designing and making principles related to different hardwoods, softwoods, and regenerated boards in the context of a life cycle analysis, drawing upon well-considered, relevant examples.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	2-3	Demonstrates and applies a generally sound knowledge and understanding of the suitability of using different hardwoods, softwoods, and regenerated boards in the context of a life cycle analysis. Generally well-considered, relevant issues identified.	3-4	Demonstrates and applies a generally sound knowledge and understanding of designing and making principles related to different hardwoods, softwoods, and regenerated boards in the context of a life cycle analysis. 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	Demonstrates and applies a basic knowledge and understanding of technical principles related to the suitability of using different hardwoods, softwoods, and regenerated boards in the context of a life cycle analysis. Few issues are identified.	1-2	Demonstrates and applies a basic knowledge and understanding of designing and making principles related to different hardwoods, softwoods, and regenerated boards in the context of a life cycle analysis. Few examples are provided.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		