



GCE AS MARKING SCHEME

SUMMER 2024

**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 2024 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 are of a copper coated saucepan.

- Describe **two** properties of copper that make it an appropriate material for coating the saucepan.
- Explain **two** different functional qualities to be considered when designing the copper saucepan.
- Explain **one** reason why PTFE is suitable for coating the inside of the saucepan.

Q1	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 copper that makes it appropriate for the saucepan and 1 mark for the justification up to a total of 4 marks.

- Copper is an ideal heat conductor [1] and will therefore be suitable for transferring heat from the heat source to the contents to be cooked [1].
- Copper is durable [1] that is ideal for the wear the product will go through over time. [1]
- Copper has a high aesthetic value and will maintain its appearance over time [1] therefore it will maintain a high quality finish [1]
- Copper is stain resistant/dishwasher safe/noncorrosive [1] making it suitable for cooking with a variety of acidic foods/can take the chemicals required during washing [1]
- Copper has a high melting point [1] suitable to resist heating [1]

Credit any other appropriate response.

				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 comment up to a total of 4 marks.

- The product's capacity needs to be considered [1] to enable a range of food products to fit inside it [1].
- The size of the saucepan needs to be considered [1] it fits on a range of hob sizes to carry out its purpose [1].
- The material of the handle needs to be considered [1] to ensure it does not conduct heat and cause the user to burn themselves [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]

Do not accept repeat answers from 1a

Credit any other appropriate response.

				AO3		AO4					Total
						1a	1b	1c			
(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.

PTFE has high flexural strength, even in low temperatures [1] making it strong as a coating on complex shapes [1]

PTFE has resistance to water [1] making it ideal; for liquids and fluids when cooking [1]

PTFE is non-toxic [1] odours will not go into the food/will provide safety for the consumer [1]

Credit any other appropriate response.

Question 2

The square section of drainpipe pictured below is made from UPVC.

- (a) Explain **two** properties of UPVC that make it a suitable material for the drainpipe.
- (b) Below is a cross-section of a UPVC drainpipe.
- (i) Calculate the volume of UPVC required for the 1m drainpipe in millimetres rounded to a whole number.
- (ii) UPVC costs 1 pence per gram. Calculate the UPVC material cost of 1m of drainpipe.

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 UPVC and 1 mark for a justification or supporting reason up to a total of 4 marks

UPVC is very dense and hard [1] providing the product with durability [1]

UPVC is waterproof [1] making it ideal for a drainpipe/guttering [1]

UPVC has weather and UV resistance [1] enabling the product to be used outdoors [1]

Credit any other appropriate response.

				AO3		AO4				Total
							1c			
(b) (i)		2					4			4
Candidates should demonstrate understanding and be awarded up to 4 marks based on: $V = \pi r^2 h$ Half the diameter of both the internal and external shapes $100/2 = r50$ $94/2 = r47$ Outside Cylinder $V = \pi r^2 h$ $V = \pi \times 50^2 \times 1000$ $V = \pi \times 2500 \times 1000$ $V = 7,853,981.633974483\text{mm}^3$ 1 mark Inside Cylinder $V = \pi r^2 h$ $V = \pi \times 47^2 \times 1000$ $V = \pi \times 2209 \times 1000$ $V = 6,939,778.171779853 \text{ mm}^3$ 1 mark Deduct Volume of inside cylinder from outside cylinder $7,853,981.633974483 - 6,939,778.171779853$ 1 mark $= 914,203.46219463$ Rounded to a whole number $914,204\text{mm}^3$ or 914203mm^3 1 mark Accept π calculations that result in the correct answer <i>Credit any other appropriate mathematical response. Allow for Rounding Errors</i>										
(ii)		2					3			3
Candidates should demonstrate understanding and be awarded up to 3 marks based on: Do not penalise for errors made in 2(c) (i) Convert Cubic mm to grams $914204/1000$ 914.204 grams 1 mark Times grams by cost per gram $= 914.204 \times 0.01$ 9.14204 1 mark Rounded = £9.14 1 mark <i>Credit any other appropriate mathematical response.</i>										

Question 3

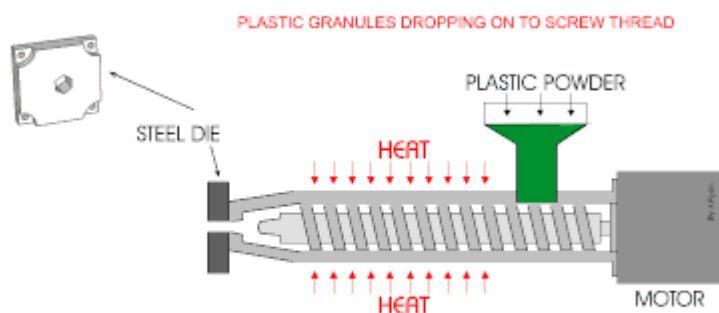
Study the images below of a kitchen chair.

- Using notes and diagrams, describe how injection moulding has been used to produce the seat of the kitchen chair.
- Explain how the properties of polypropylene make it a suitable material for the seat of the kitchen chair.
- Discuss how ergonomics and anthropometrics play an important part in the design of the chair.

Q3	Science	Maths		AO3		AO4						Total
						1a	1b	1c	2a			
(a)						5						5

Candidates should demonstrate knowledge and are awarded up to 5 marks.

The candidate should produce a diagram with appropriate supporting notes to be awarded the full 5 marks. Award up to 3 marks for appropriate notes without diagrams. Award up to 3 marks for detailed diagrams but without any appropriate notes.



- The mould opens and is filled with powdered polymer and closed.
- The mould moves to the next stage, where it is heated to 300°C whilst moving along the Archimedes screw via the motor.
- The polymer is injected into the seat mould [steel die]
- The mould is water cooled and the mould pushed out by rods.

Credit any other appropriate response.

				AO3		AO4						Total
						1a	1b	1c	2a			
(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.

Polypropylene is durable [1] making it ideal for a kitchen stool, which may take a lot of wear and tear. [1].

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

Polypropylene 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 injection moulded.

Credit any other appropriate response.

				AO3		AO4						Total
						1a	1b	1c	2a			
(c)							5					5

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

- When designing a product, designers consider human senses including sight, smell, touch, comfort, sound and temperature. [1]
- 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 [1]
- If a product is ergonomically designed the chances are is that it will be a successful product. The user will be able to use the product comfortably. [1]
- 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. [1]
- Contouring should be used to support the lumbar curve of the back. [1]
- Feet should comfortably reach floor to avoid pressure on the back of the legs. [1]
- The chair should fit comfortably under a dining table providing an adequate gap for the legs. [1]

Credit any other appropriate response.

Question 4

Study the details of the acrylic mobile phone stand shown below.

- (a) Calculate the surface area of the phone stand A diagram.

Below is an alternative phone stand design the manufacturer wants to make.

- (b) Calculate whether Phone stand Design A or Phone stand Design B contains the least amount of acrylic.

Q4	Science	Maths		AO3		AO4					Total
						1a	1b	1c			
(a)		✓						3			3

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

Area of the Main Rectangle = $300 \times 80 = 24000\text{mm}^2$
1 mark

Area of Second Rectangle = $10 \times 205 = 2050\text{mm}^2$
 Area of Third Rectangle = $10 \times (80-40) = 400\text{mm}^2$.
1 mark

Main Rectangle – Second + Third Rectangle
 $24000 - (2050 + 400) = 21550\text{mm}^2$.
1 mark

Accept any appropriate mathematical process.

				AO3		AO4					Total
						1a	1b	1c			
(b)		✓						5			5
Candidates should demonstrate knowledge and understanding and be awarded up to 4 marks based on: Area of the Main Rectangle without semi-circles= $[300 - 80] \times 80 = 17600\text{mm}^2$ 1 mark Area of Hole - $V = \pi r^2$ $A = \pi r^2$ $A = \pi 15^2$ $A = \pi 225$ $A = 706.8583470577035 \text{ mm}^2$ 1 mark Area of Two Semi-Circles - $V = \pi r^2$ $V = \pi 40^2$ $V = \pi 1600$ $V = 5026.548245743669 \text{ mm}^2$ 1 mark Area of Phone Design B = $17600 + 5026.548245743669 - 706.8583470577035$ $= 21,919.68989868597$ 1 mark Answer Phone Design A would take less acrylic to produce. 1 mark Accept answers that use 3.14 for the π calculation Do not penalise for any errors carried forward from 4a. Continue to award marks if you can clearly see the mathematical method used by the candidate. Allow for Rounding Errors. Accept any appropriate mathematical process.											

Question 5

The image below shows a dental brace made from a shape memory alloy.

- (a) Describe **two** reasons why a shape memory alloy has been used over more traditional materials for the dental brace.
- (b) Describe **two** advantages of using Polymorph to model ideas as part of the iterative design process.
- (c) Explain how thermochromic materials can be used in products to ensure safety for the user.

Q5	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 and description and 1 mark for a justification or appropriate supporting comment up to a total of 4 marks.

Nickel-titanium (NiTi) shape-memory alloys (SMAs) have been used in the manufacture of orthodontic wires [1] due to their shape memory properties [1]

SMA have super-elasticity [1]

SMA have high ductility [1] making it ideal for the manufacture of wire [1]

SMA have good resistance to corrosion [1] making it ideal for the environment in which it will be placed [1]

SMAs have greater strength and lower modulus of elasticity [1] when compared with stainless steel alloys [1]

Credit any other appropriate response.

				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.

Polymorph is a thermoplastic material that can be shaped and reshaped any number of times. It is normally supplied as granules that look like small plastic beads. It can be heated in hot water and when it reaches 62 degrees centigrade the granules form a mass of 'clear' material.

Polymorph can be used to quickly model an idea such as a handle [1] speeding up the design process [1]

Polymorph can be added to [1] making iterations quicker [1]

Polymorph can produce a physical 3D object such as a handle [1] which can be tested for fit and comfort [1]

Polymorph can be sprayed or finished [1] therefore allowing the designer to see different aesthetic variations [1]

Polymorph is a relatively cheap process [1] therefore cutting down on design and manufacturing costs [1]

Polymorph can be machined easily [1] making it easy to shape and form and make further refinements [1]

Polymorph can be used for indoor and outdoor modelling of products/is water repellant [1] giving great flexibility in terms of the range of products that can be modeled [1]

Credit any other appropriate response.

				AO3		AO4					Total
						1a	1b	1c			
(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.

Thermochromic is the property of materials to change colour due to a change in temperature.

Example products include baby spoons, kettles, cups, thermometers

Products change colour and give a visual representation of the heat of a product in use [1] to indicate if the food/liquid is too hot [1] to indicate the temperature of a thermometer providing a guide to the health of the user [1]

Credit any other appropriate response.

Question 6

The product below is certified by the *British Standards Institute* (BSI) and the *Conformité Européenne* [CE]

Explain the advantages to the consumer of purchasing products with relevant safety marks.

Q6	Science	Maths		AO3	AO4					Total
					1a	1b	1c	2a	2b	
					2			4		6

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

International standards marking helps to support basic consumer rights, such as the right to safety and the right to be informed [1]

CE and BSI marking is the manufacturer's declaration that the product meets the requirements of the applicable British and EC directives and as such helps support basic consumer protection helps to raise levels of quality [1], safety [1], reliability[1] in products which is better for the consumer . [1]

If placed on a product it means that the product has met a standard which means it can be legally be sold in the European Economic Area this protects the consumer in terms of legal protection and litigation for damages. [1]

This protects the consumer as they have assurance that the product will be safe and has gone through rigorous testing [1]

Consumers can make better purchase decisions by looking for the marking and not purchasing products without the marking [1]

Credit any other appropriate response.

Question 7

Examine the two hot drinks travel mugs pictured below

- (a) Analyse the physical properties of the materials that make them suitable for these products
- (b) Evaluate how the material choices for the two travel mugs impacts on their carbon footprint

Q7	Science	Maths		AO3		AO4				Total
				2a	2b	1c	2a	2b	2c	
(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 6 marks.

Indicative content

Qualities required for a hot drinks travel cup:

Heat resistant, odourless, hygienic easy to clean, chemical resistance, easy to colour, easy to shape, and durability

Stainless Steel - High and low temperature resistance, ease of fabrication, aesthetic appeal, hygiene and ease of cleaning.

Silicon rubber - higher heat resistance and chemical stability, high elasticity and compressibility. Inertness, that is no taste or smell, Translucent and easy to colour, wide hardness range

Polypropylene - Semi-rigid, translucent and easy to colour, good chemical resistance, , good fatigue resistance, good heat resistance.

Bamboo Fibre – odourless, rot resistant, fibre easy to mould, Easy to add colour, transfer print.

Credit any other appropriate response.

Band	Marks	AO3 2a
2	4-5	Good analysis of the physical properties of the materials that make them suitable for the products. 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
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.
1	1-3	Limited analysis of the physical properties of the materials that make them suitable for the products. Little evidence of deconstructing information and limited connections are made. Few factors are identified.
		There is limited evidence of relevant examples or structure.
	0	No response or work that is worthy of a mark

				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.

Issues that the learner could be discussing:

Stainless Steel – finite resource – pollution of extraction of ore and producing the alloy – can be recycled as a separate material

Polypropylene – finite resource – oil based. Pollution from extraction and refining.

Bamboo very sustainable – fast growing and plentiful – renewable resource – can be biodegradable

Silicon Rubber – easy to recycle. Not biodegradable.

Transport of materials applies in all material areas. Manufacturing of the parts produce pollution in all material areas.

Stainless Steel Cup is harder to recycle as it cannot easily be split into separate materials.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 1c
2	3-4	Good evaluation of how the material choices made impacts on their carbon footprint. A sound discussion which appraises and/or makes judgements about the impacts of the carbon footprint. 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 materials against the carbon footprint. 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 the material choices made impacts on their carbon footprint. Little evidence of appraising or making judgements about the carbon footprint.	1	Applies a basic knowledge and understanding of technical principles to the context materials against the carbon footprint.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 8

The watches below are designed to track the fitness and activity of the user. Analyse how market pull and technology push forces have influenced the development of such watches.

Q8	Science	Maths		AO3		AO4					Total
				2a		2a	2b	2c			
				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:

The term '**Market Pull**', refers to the need/requirement for a new product or a solution to a problem, which comes from the **market** place. The need is identified by potential customers or **market** research. A product or a range of products are developed, to solve the original need.

Consumers need to track fitness and health activity. Calorie burn, heartbeat monitoring. The ability to use technology as a social media platform.

The need to have a number of features additional to fitness tracking.

The watch can be available in different coloured straps and could be brought separately or be interchangeable. The watch can also be more sustainable here as straps could be replaced if damaged but retain the head part.

Technology Push is when research and development in new technology, drives the development of new products.

Research and Development – New Product – Introduced to the public

Technology Push usually does not involve market research. It tends to start with a company developing an innovative technology and applying it to a product. The company then markets the product.

Technology Push is where the **technology** is available and the designers make a product to use it. The best **example** of this is touch screen **technology**,

Relevant technological advances relevant to Fitbits include:

- Bluetooth technology,
- synchronising to other devices.
- GPS Technology.
- Miniaturisation

Technology push drives competition.

Candidates need to analyse when during a product development it is influenced by market pull or technology push. Including the recognition that in many cases both have an impact on the development of a product.

Credit any other appropriate response.

Band	Marks	AO3 2a	Marks	AO4 2c
3	4-5	Excellent analysis how market push and technology pull impacts the development of such watches. 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, market push and technology pull.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	2-3	Good analysis how market push and technology pull impacts the development of such watches. 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 market push and technology pull.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1	Limited analysis how market push and technology pull impacts the development of such watches. 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 market push and technology pull.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 9

Evaluate the range of factors a designer would have to consider to ensure the wireless headphones shown below are fit for purpose.

Q9	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:

If a product is going to be fit for purpose the following considerations must be made:

Price - The designer must ensure the product is sold at a reasonable price i.e. a price that a consumer will be prepared to buy the product and is the product priced compared to similar products on the market. The designer can rely on brand recognition and kudos and may include additional features or emphasise unique design elements to secure a better price. Do consumers pay a premium for quality.

Performance – The designer needs to ensure that their product do things as well or better compared to similar products on the market. Headphones may include ease of use, effectiveness of noise cancelling, combinations of treble and bass and how they actually sound. Expensive = high performance expectations from the consumer. The ability to be worn indoors/outdoors, during exercise will affect material choices e.g. robust and impact resistant.

Aesthetic Appeal – Style, appearance, shape, finish are all considerations in the design of the headphones. Connections to ergonomics and anthropometrics, assuring the product meets the needs of many users. Considerations to cost of manufacture and meeting the needs of the consumer, and creating a range of products to increase the market appeal for consumers.

Reliability – Will the product last a long time without breaking down. Does the brand provide quality products. Is the product more reliable than similar products on the market. Do consumers have confidence in the product and the brand. Links to design obsolescence versus consumers expectations of lifespan of product. Build quality should reflect the price and market.

Function – ensuring it will fit users heads, the ability to hang it around the neck when not being used. Adjustability for a range of users head sizes. Battery power, wifi, Bluetooth features as well as connectivity with other devices.

Candidates must consider how to balance off the needs of the consumer and competitors to make judgements between the considerations when designing the headphones.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 2c
3	5-6	Excellent evaluation of the issues a designer may have to consider to ensure the product is fit for purpose. 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 fit for purpose. 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 issues a designer may have to consider to ensure the product is fit for purpose. 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 fit for purpose. 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 issues a designer may have to consider to ensure the product is fit for purpose. Little evidence of appraising or making judgments.	1	Applies a basic knowledge and understanding of technical principles related to fit for purpose.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 10

The modern storage racks shown below are manufactured using standardised components, parts and materials .

Discuss the advantages and disadvantages of using standardised components, parts and materials to the manufacturer if the modern storage racks.

Q10	Science	Maths		AO3		AO4				Total
							1c	2b	2c	
	✓					5		7		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:

Standardised parts are a key feature in saving manufacturing costs in industry.

To reduce staffing, machinery, and costs companies do not make all their own parts. They buy in standardised parts or part assembled components to assemble and create the final product. These can include nuts, bolts, screws, springs or circuit boards and in the case of the examples shown knock down fittings.

They have to be sure the components are of a high standard, safe, within tolerance [correct size, shape, weight etc.]

Many parts need to use standardised sizes e.g. metric thread.

A key feature is that standardised parts arrive just before the product is manufactured. JIT

Advantage to company

- They don't need to specialise in creating the standardised part
- No space required in the factory to make these parts
- Save costs – no extra machinery/staff needed to produce these parts.

Disadvantage to the company

- Quality cannot be guaranteed [many companies have to put in quality control processes]
- Dependency on other companies for stock and delivery – may cause issues in JIT if not delivered in time/

Advantages to the Manufacturer standard stock forms of materials:

- Standard forms can be transported and handled more easily than raw materials therefore reducing costs to the manufacturer and therefore reducing the cost price of the product.
- Designers use readily available standard stock sizes of materials when designing products and therefore reduce costs.
- Readily available standard stock sizes lead to consistency in design across different companies
- Standard forms and sizes are generally the same in most countries [international standard] and therefore promote global production
- The net reduction in costs in using standard forms to the manufacturer can be passed onto the consumer and therefore lead to lower prices for products.
- Standard forms and sizes are cheaper than special sizes.
- Many standard form and sizes are good for the environment as the manufacturer can calculate how to get the most material from the tree including using waste products to make manufactured boards

Advantages to the Consumer/Manufacturer standard stock forms of materials:

- Standard stock forms can restrict innovation and creative/bespoke designs.

Credit any other appropriate response.

Band	Marks	AO4 1b and 1c	Marks	AO4 2b and 2c
3	4-5	Demonstrates and applies a thorough knowledge and understanding of technical principles related to the advantages and disadvantages of using common standardised parts and materials to the manufacturer. Well-considered, relevant wider issues identified.	5-7	Demonstrates and applies a thorough knowledge and understanding of designing and making principles related to common standardised parts and materials, 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 advantages and disadvantages of using common standardised parts and materials to the manufacturer. Generally well-considered, relevant issues identified.	3-4	Demonstrates and applies a generally sound knowledge and understanding of designing and making principles related to common standardised parts and materials. 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 advantages and disadvantages of using common standardised parts and materials to the manufacturer. Few issues are identified.	1-2	Demonstrates and applies a basic knowledge and understanding of designing and making principles related to common standardised parts and materials. Few examples are provided.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		