



GCE A LEVEL MARKING SCHEME

SUMMER 2022

**A LEVEL
DESIGN AND TECHNOLOGY – PRODUCT DESIGN
A602U10-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

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

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

GCE A LEVEL DESIGN AND TECHNOLOGY

SUMMER 2022 MARK SCHEME

COMPONENT 1 - PRODUCT DESIGN

Question 1

The image below is of a mass-produced sideboard made from seasoned timber.

- (a) Name **one** method used to season timber [1]
- (b) Explain why using seasoned timber is necessary to manufacture the sideboard. [3]
- (c) Describe in detail the process of seasoning wood most commonly used for products such as the mass-produced sideboard. [4]

Q1	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c			
(a)						1					1

Candidates should demonstrate knowledge and be awarded 1 mark for correct identification of a seasoning process, such as:

Air dried, or
kiln dried

Credit any other appropriate response.

(b)							2	1			3
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Candidates should demonstrate understanding and be awarded up to 3 marks.

- Unseasoned wood has a tendency to twist, warp, cup, bow or cracks can appear making it difficult to work with [1]
- Greater immunity from decay and increased resistance to rot [1]
- Increased strength and stability [1]
- Helps preservatives to penetrate [1]
- Makes wood less corrosive to metals (the sideboard has metal legs) [1]

Credit any other appropriate response.

(c)						4					4
Candidates should demonstrate understanding and be awarded up to 4 marks based on description of kiln drying: - Planks are stacked on trolleys and placed into a kiln [1] - Planks are separated with joists/beams to allow air to flow around them [1] - In the kiln temperature and humidity are controlled [1] - Atmosphere in kiln is gradually changed so that the temperature increases and the humidity decreases [1] - Planks are removed from the kiln where they are checked for defects before processing into final products [1] Also accept description of air drying: - Planks are placed on seasoning boards/trolleys a wide distance apart [1] - They are stored in a shed, hut or building with two open sides to allow for air flow [1] - Moisture content cannot be controlled as circulating air varies in content depending on time of year and weather [1] - The planks are removed after a period of about a year (thick hardwood planks) and checked for defects before being graded. [1] Credit any other appropriate response.											

Question 2

Below is a CAD drawing of a table design. The design feature on the top will be an epoxy resin cast with a blue tint.

- (a) (i) Calculate the surface area of the epoxy resin cast part of the table.
Show all calculations [3]
- (ii) The designer has decided to insert a strip of LED lights around the perimeter of the epoxy resin cast.
Calculate the length of LED strip lights required.
Show all calculations [3]
- (b) The LED strip lights will be bought in components. Explain what is meant by the term 'bought in components'. [2]
- (c) Describe the benefits to the manufacturer of using bought in components. [3]
- (d) Explain the risks to the manufacturer of relying on the use of bought in components. [3]

Q2	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
(a)		6					6				6

Candidates should demonstrate understanding and be awarded up to 6 marks based on appropriate mathematical calculations such as:

- (i) Area of a triangle formulae $A = \frac{1}{2} b h$ [1]
 $A = 1.2 \times 10^5$ [1] Accept 129,600mm² [1]
- (ii) Side C calculation formulae
 Calculates c, $\angle B$, and $\angle A$ based on given b, a, and $\angle C$. [1]
- Side C calculation
 $c = \sqrt{b^2 + a^2 - 2ba \cdot \cos(C)} = 415.78283$ [1]
- Perimeter $a+b+c$ [1]
- Perimeter calculation = 1845mm [1]

Do not penalise for any errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate.

Award marks across 2a(i) and 2a(ii) if calculations can clearly be seen (up to maximum of 6).

Accept any other mathematical method to achieve the answer.

(b)									2		2
Candidates should demonstrate understanding and be awarded up to 2 marks based on an explanation of bought in components, such as: Bought in components are those which have been manufactured and delivered by a third party for inclusion in a product, these could be specialist parts or specialist sub-assemblies such as the LED strip lights or motors [1]. They could also be bought in as standardised parts which are those parts/components that have been manufactured to a set of commonly agreed standards and will be the same irrespective of which company has manufactured them, e.g. M4 machine screw [1]. <i>Credit any other appropriate response.</i>											
(c)							3				3
Candidates should demonstrate understanding and be awarded up to 3 marks based on: (credit one mark for each fully explained point) • Quality control is managed by the manufacturer of the component so they have the responsibility to make sure it works and functions as it should [1] • Specialist skills, tools and equipment are not required to make the component which will reduce overheads, (or they do not have to set up a specialist manufacturing facility) [1] • Money is not tied up in machinery, equipment and tools that may be specific to a particular part/component [1] • Having the advantage of 'shopping around' to get the best price and quality from specialist suppliers [1] • Having the freedom to switch suppliers to take advantage of innovations in the market or new techniques that one supplier may be developing; you are not tied to one method of making the components [1] <i>Credit any other appropriate response.</i>											
(d)							3				3
Candidates should demonstrate application of knowledge and understanding and be awarded up to 3 marks based on the risk of using third party suppliers for bought in components • If a business fails or goes into administration then they may not be able to get hold of the specialist parts they need [1] which could halt production or even lead to a re-design which could be costly [1] • If components are bought in from other countries, fluctuation in currency value can affect the cost of supply of parts or raw materials [1], this could mean a sudden price rise for consumers or the company having to take a hit in profits [1]. • Delays in delivery of parts can halt or delay production [1]. <i>Credit any other appropriate response.</i>											

Question 3

The main body of the keyboard shown is made from aluminium.

(a) Briefly describe the process of extracting aluminium from its natural material. [2]

(b) Explain the environmental impact of extracting aluminium [6]

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

Candidates demonstrate knowledge are awarded up to 2 x 1 marks

Award one mark for each briefly described stage up to 2 marks:

- Aluminium is extracted from an ore (bauxite) [1]
- The ore is crushed, dried and ground in special mills where it is mixed with a small amount of water. [1]
- This process produces a thick paste that is collected in special containers and heated with steam to remove most of the silicon present in the bauxites [1]
- The ore is loaded into autoclaves. Aluminium oxide appears in the resulting slurry
- At an aluminium smelter, alumina is poured into special reduction. Electric currents are then introduced in the mixture. [1]
- Electrolysis is used to extract the aluminium and carbon anode and cathodes are used. [1]

Do not award marks for stating the raw material

Credit any other appropriate response.

(b)						2			4		6
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Candidates demonstrate knowledge and are awarded up to 6 marks.

- Requires huge amount of energy in the form of electricity and water to produce. [1]
- Huge amount of electricity required to yield final product, most of which is supplied by coal. [1]
- Strip-mining process removes all vegetation in the mining region resulting in a loss of habitat and food for the local wildlife as well as significant soil erosion [1]
- The 'red sludge' and toxic mine tailings that remain are commonly deposited into excavated mine pits where they ultimately seep into aquifers, contaminating local water sources. [1]
- Greenhouse gas emissions released during smelting and processing (which have been found to blanket surrounding regions with toxic vapours) [1]
- Particulates released during processing that are known to compromise air quality include combustion by products, caustic aerosols, dust from bauxite, limestone, charred lime, alumina and sodium salt all of which are damaging to humans and wild life. [1]
- Noise pollution can harm surrounding habitats for animals and humans. [1]

Credit any other appropriate response.

Question 4

Below is an image and details of a stool designed by a student. It features 30mm diameter mild steel tube legs that have been powder coated.

- (a) (i) Describe the process of powder coating a steel tube [2]
(ii) Explain **one** benefit of powder coating as a finish for mild steel. [2]
- (b) Calculate the length of steel tubing required to make both legs of the stool. [7]
Show all calculations
- (c) The 30mm diameter mild steel tubing weights 0.9kg per linear metre. Using your answer from 4(b), calculate the weight of the stool legs. [2]
Show all calculations

Q4	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c			
(a)	x					2	2				4

Candidates should demonstrate knowledge and understanding.

Up to 2 marks for a description of the process and up to 2 marks for the benefit of powder coating as a finish

- (i) The steel tube is statically charged [1]
Positively charged polymer resin is sprayed through an air gun and then Baked [1]

Accept alternative process which is sometimes found in schools:

Mild steel is heated using a convection oven or brazing hearth [1]

The heated steel is dipped into a fluidised powder bath where the powder melts onto the surface of the steel [1]

- (ii) The charge means there is a strong bond between the steel and the powder [1], this makes the coating hardwearing [1].
The powder coating provides a waterproof barrier [1] which will stop the steel from rusting if it comes into contact with water or humid conditions [1].

Credit any other appropriate response.

(b)		7					7			7
<i>Do not penalise for any errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate.</i> Based on one side 2 x lengths of 250mm and 2 x lengths of 200mm tube = 900mm [1] Corner section: Stage one – find the mean radius of bend: Radius + 0.5 x tube diameter [1] $45 + 0.5 \times 30 = 60\text{mm}$ [1] Stage two - Length of steel tube through the bend: $2 \times \pi \times \text{mean radius} \times \text{angle of arc} / 360$ [1] $2 \times 3.14 \times 60 \times 90/360 = 94.2\text{mm}$ [1] Stage three - add linear lengths to bend sections: $94.2 \times 4 = 376.8\text{mm}$ [1] $376.8\text{mm} + 900\text{mm} = 1276.8\text{mm}$ [1] Stage four – calculate for both legs $1276.8\text{mm} \times 2 = 2,553.6\text{mm}$ [1] <i>Credit any other appropriate response.</i> Accept answer where candidate has used external radius: Alternative if the candidate has used the external radius of the bend in the tube: (no credit for stage one as mean not used) Stage two – length of steel tube through bend: $2 \times \pi \times \text{radius} \times \text{angle of arc} / 360$ [1] $2 \times 3.14 \times 75 \times 90/360 = 117.75$ [1] Stage three – add linear lengths to bend sections: $117.75 \times 4 = 471\text{mm}$ [1] $471\text{mm} + 900\text{mm} = 1371\text{mm}$ [1] Stage four – calculate for both legs $1371\text{mm} \times 2 = 2742\text{mm}$ [1]										
(c)		2					2			2
<i>Do not penalise for any errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate.</i> Value from 4(b) converted to metre lengths 2.5536 metres [1] $2.5536\text{ metres} \times 0.9 = 2.29824\text{kg}$ (accept 2.29kg) [1] <i>Note: It is possible that candidates will have calculated their answer in Newtons therefore it must be multiplied by 9.81. Formula below:</i> $F = m \times 9.8 \text{ m/s}^2$ <i>Therefore accept the following answer 22.5457344N</i> <i>Credit any other appropriate response.</i>										

Question 5

During the design and manufacture of products, such as the scooter pictured below, a range of tests are carried out.

- (a) Explain the difference between destructive and non-destructive material testing. [2]
- (b) Describe the reasons why designers and manufactures carry out both types of tests when designing the scooter. [4]
- (c) Using notes and sketches, describe an industrial test that could be carried out to assess a material's relative toughness for the scooter. [4]

Q5	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c			
(a)	x					2					2

Candidates should demonstrate knowledge and be awarded 1 mark for the correct explanation of each term.

Destructive testing will test a material's properties to the breaking or fracture point so that the property limits can be established [1]

In non-destructive testing no loads are applied so materials are not damaged as a result; non-destructive testing looks for material defects [1]

Credit any other appropriate response.

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

Both destructive and non-destructive categories must be described for full allocation of marks. One mark for each correctly explained point such as:

- Flaws in the products design can seriously affect the safety of the scooter in use which could end up causing injury [1]
- If flaws in the product design/manufacture technique are not picked up before manufacture begins then the scooter would have to be recalled if an issue arose, leading to the extra time and cost associated with fixing the problem, and the damage to the brand image [1]
- Fixing products before or during early stages of manufacture is less costly than applying fixes at the end or even after manufacturing has finished [1]
- Destructive tests need to be carried out to establish limits of the forces that can be applied before product failure thus ensuring the scooter will not break during normal use [1]

Credit any other appropriate response.

(c)

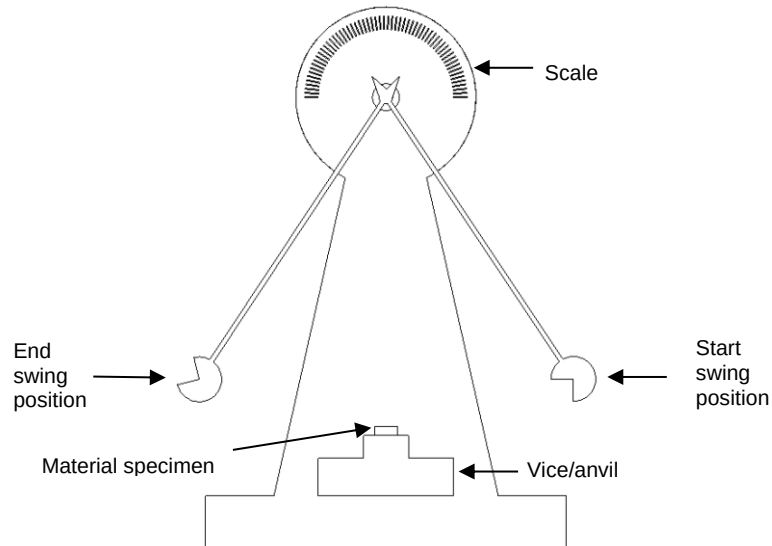
4

4

Toughness Testing

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

No marks are to be awarded for a sketch that **does not describe** the process.



- Award [1] mark for a diagram that clearly shows the process e.g. showing start and end position of hammer swing.
- The specimen is supported at its two ends on an anvil/vice and struck on the opposite face to the notch by the pendulum [1]
- The amount of energy absorbed in fracturing the test-piece is measured and this gives an indication of the notch toughness of the test material [1]
- The pendulum swings through during the test, the height of the swing being a measure of the amount of energy absorbed in fracturing the specimen [1]
- Conventionally, three specimens are tested at any one temperature and the results averaged. Alternatively, tests are carried out at a range of temperatures in order to generate a ductile to brittle transition curve. [1]

Candidate must make reference to measurable, repeatable test to gain full marks for the question.

Credit any other appropriate response.

Question 6

Explain the benefits of Computer Integrated Manufacturing (CIM) to the **designer and manufacturer** when producing products such as an adjustable office chair. [5]

Q6	Science	Maths		AO3		AO4				Total
				2a	2b	2a	2b			
							5			5

Candidates should demonstrate understanding of the benefits of CIM and are awarded up to 5 marks. One mark for each correctly explained benefit.

Points could include:

Designer

- Faster responsiveness to the market. Improved product development cycles, high levels of human and capital resource productivity, improved quality, and short delivery time, lead CIM users to a rapid response to the market place. [1]
- Quality improvements. CIM supports customer satisfaction resulting from the elimination of waste from the design, engineering and production cycle. [1]
- Easy to communicate design drawings to automated manufacturing processes [1].

Manufacturer

- Cost reduction. Better use of capital resources through work automation results in higher productivity and lower cost. The automation of the entire production process shifts management's emphasis from supervising people to supervising machines. [1]
- Greater production control. Company's efficiency increases through work simplification and automation, better production schedules planning and better balancing of production workload to production capacity. [1]
- Reduced Inventory. Reduced investment in production inventories and facilities through work simplification, and just in time inventory policies. [1]
- Small lot manufacturing. CIM is based on small lot sizes and offers greater variety of products. [1]

Credit any other appropriate response.

Question 7

Study the images of the baby car seats shown below.

- (a) Analyse how 'market pull' forces have impacted on the development of baby car seats over time. [6]
- (b) Study the child booster seat shown below and evaluate why polypropylene is a suitable material for use in this product. [6]

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

Candidates should show evidence of logical reasoning or deconstructing information and applying this to be awarded 6 marks.

Indicative content

- Greater comfort and support for the baby. As products in all sectors benefit from greater comfort parents are demanding the same for their babies forcing companies to take greater care when considering anthropometric data and ergonomics.
- Greater protection from automobile accidents. Consumers demand ever increasing standards of safety and will often pay a premium for brands that can prove that their product is safer than the competitors.
- Easier to get secure into car and release. The development of quick release mechanism (also known as Iso-Fix) was in response to parents demanding easier and more convenient to use. Companies who responded to the need quickest saw the greatest surge in sales.
- Integrates into buggy system so it is dual purpose. As the cost of baby equipment rises, consumers demanded lower cost but still wanted high quality goods. The response was to make products dual purpose so the seat acts as a car seat and a top for the buggy.
- Integrated carry handle. In response to the need for products to be easy to use and handle, particularly as the baby can be heavy and is carried on one side of the body which can be difficult.
- Sun visor protection added in response to increased awareness of the damage UV light can cause and the parental pressure applied to companies to develop a solution that would work for both use in the car and on top of the buggy frame.

Credit any other appropriate response.

Band	Marks	AO3 2a	Marks	AO4 2c
2	3-4	Good analysis of market pull forces influencing design choices. 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 market pull forces that have been influencing design choices.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited analysis of market pull forces influencing the design choices. 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 of market pull forces influencing design choices.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

(b)					4		2			6
Candidates should show clear evidence of appraisal and/or <u>making judgements</u> and <u>applying</u> this to technical principles to be awarded up to 6 marks. Responses should provide explanation of material suitability in the context of the booster seat use in order to be awarded credit. Indicative content: • The booster seat needs to have good impact resistance to avoid breaking or shattering on impact. Polypropylene flexes under pressure but does not break. • Fire retardants can be added during manufacture which is a useful when designing products that will be used in a car. • Can be injection moulded or blow moulded and so can be mass produced. The booster seat is relatively low cost and is in high demand. Mass manufacturing techniques need to be used in order to make it financially viable. • It is self-coloured and self-finishing so colours can be changed regularly including for 'special edition' pieces or to highlight parts of the product that can be pressed to 'adjust'. • Easily cleaned and chemical resistant. The booster seat is likely to get wet and dirty and needs to be easy to maintain. • Durable and resistant to scratches. The booster seat is likely to be knocked and jostled in the course of normal use and must not degrade or get worn. • Widely recycled. Consumers and manufactures are more environmentally aware now and so they will often opt for materials that come from a recycled source and/or can be recycled at the end of its life. As this is a high-volume product this is even more important. • Good strength to weight ration which allows the seat to be removed/moved easily. <i>Credit any other appropriate response.</i>										

Band	Marks	AO3 2b	Marks	AO4 1c
2	3-4	Good evaluation of suitability of material for booster seat application. A sound discussion which appraises and/or makes judgements about the material suitability in this application. 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 of polypropylene being used for the booster seat. 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 suitability of booster seat application. Little evidence of appraising or making judgements about suitable the material is for use in this application.	1	Applies a basic knowledge and understanding of technical principles of polypropylene being used for the booster seat.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 8

Analyse the range of methods that can be used to conduct market research when carrying out 'User Centred Design'. [9]

Q 8	Science	Maths		AO3		AO4					Total
				2a	2b	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. Focus should be on the analysis of the factors, though candidates are expected to apply knowledge and understanding of designing and making principles in the deconstruction of information and discussion.

Definition of User Centred Design:

'User-centred design' is an iterative design process in which designers focus on the users and their needs in each phase of the design process. In this, design teams involve users throughout the design process via a variety of research and design techniques, to create highly usable and accessible products for them'.

Candidate must make reference to consulting the user/target market throughout the process to gain full 9-mark allocation.

Answers may include the following:

Surveys. With concise and straightforward questionnaires, you can analyse a sample group that represents your target market. The larger the sample, the more reliable your results will be. Surveys can be carried out at any point in the design process and the results of which are fed back in to the design process. There are several different ways a survey can be carried out, these include:

- In-person surveys are one-on-one interviews typically conducted in high volume traffic areas such as shopping centres or town centres. They allow you to present people with samples of products, packaging, or advertising and gather immediate feedback. In-person surveys are costly.
- Telephone surveys are less expensive than in-person surveys, but costlier than mail. However, due to consumer resistance to relentless telemarketing, convincing people to participate in phone surveys has grown increasingly difficult.
- Mail surveys are a relatively inexpensive way to reach a broad audience. They're much cheaper than in-person and phone surveys, but they only generate response rates of 3 percent to 15 percent. It can be difficult to motivate consumers to respond to mail surveys
- Online surveys can generate unpredictable response rates and unreliable data, because you have no control over the pool of respondents. But an online survey is a simple, inexpensive way to collect anecdotal evidence and gather customer opinions and preferences.

Personal interviews. Like focus groups, personal interviews include unstructured, open-ended questions. Focus groups and personal interviews provide more subjective data than surveys. The results are not statistically reliable, which means that they usually don't represent a large enough segment of the population. Nevertheless, focus groups and interviews yield valuable insights into customer attitudes and are excellent ways to uncover issues related to new products development. They can help to develop a client profile.

Focus groups. In focus groups, a moderator uses a scripted series of questions or topics to lead a discussion among a group of people. These sessions take place at neutral locations, usually at facilities with videotaping equipment and an observation room with one-way mirrors. A focus group usually lasts one to two hours, and it usually takes at least three groups to get balanced results. These groups allow designers to see how several people interact with the product or idea at one time and how 'opinion formers' may influence the ideas of others.

Field trials. Placing a new product in selected shops to test customer response under real-life selling conditions can help you make product modifications, adjust prices, or improve packaging.

Body storming. Individual responses to surveys and focus groups are sometimes at odds with people's actual behaviour. When you observe consumers in action by recording them in stores, at work, or at home, you can observe how they buy or use a product. This gives the designer a more accurate picture of customers' usage habits, it may also highlight problems they did not already know about so that these too can be fed into the design process.

SECONDARY

Secondary research is simply the act of seeking out existing research and data. It is sometimes called "desk research" because you can do it from your desk. Secondary data could be database information, Twitter comments, journal articles and much more. The best thing about secondary research is that it is often free and it usually can be done relatively quickly.

Credit any other appropriate response.

Band	Marks	AO3 2a	Marks	AO4 2c
3	5-6	Excellent analysis of market research methods. A thorough discussion, which deconstructs information and demonstrates logical connections and reasoning throughout. Well-considered discussion relating back to User Centred Design approach	3	Applies a thorough knowledge and understanding of market research methods, with well-considered, broad ranging relevant factors identified.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	3-4	Good analysis of market research methods. A generally sound discussion, which deconstructs information and provides adequate connections and reasoning. Generally well-considered discussion relating back to User Centred Design approach	2	Applies a generally sound knowledge and understanding of market research methods, with generally well-considered factors identified.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited analysis of market research methods. Little evidence of deconstructing information and limited connections are made. Few factors are identified.	1	Applies a basic knowledge and understanding of market research methods.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 9

Explain how designers and/or manufacturers carry out feasibility studies for the design and manufacture of new and innovative products such as hybrid cars or bladeless fans.

[9]

Q9	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2b	2c	
							5		4		9

Candidates should demonstrate knowledge and understanding of technical principles and design and making principles and apply this to be awarded up to 9 marks based on:

The following points may form the basis of the answer:

A Feasibility Study is a formal project document that shows results of the analysis, research and evaluation of a proposed project and determines if this project is technically feasible, cost-effective and profitable. The main elements of a feasibility study:

- Technical feasibility**
 This stage determines whether a product is technically feasible. It aims to discover:
 - The purpose of the product
 - Whether a similar solution on sale already
 - Whether the product can be protected from competitors
 - What the strengths and benefits of the product are
 - What resources and techniques are likely to be needed to develop and deliver the product
 - What regulation may be in place that needs to be considered
- Market feasibility**
 - Which segments of the market the product would appeal to
 - Why consumers would purchase the product
 - How big the potential market is and what their buying patterns might be
 - How the product could be sold
 - Who the competitors are, who future competitors might be
 - What the strengths and weaknesses are of the competitors
 - Whether the product is likely to attract enough of the target market
- Commercial feasibility**
 At this stage of the process, the designer & manufacturer would establish whether it is likely the product will have commercial success. They would establish:
 - The strengths and weaknesses of their own product
 - What the potential sales might be
 - What pricing structures and strategies would be used
 - What return on investment they might get
 - How long they could last without making a sale and what the break even point might be
 - How much money it would take to get started
- Overall risk assessment**
 - What the major risks are with the product
 - How to minimise the risks

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 in the Feasibility Study theme. Well-considered, relevant wider issues identified.	3-4	Demonstrates and applies a thorough knowledge and understanding of designing and making principles considering feasibility study 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 technical principles to the Feasibility Study theme. Generally well-considered, relevant issues identified.	2	Demonstrates and applies a generally sound knowledge and understanding of designing and making principles considering feasibility study 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 to the Feasibility Study. Few issues are identified.	1	Demonstrates and applies a basic knowledge and understanding of designing and making principles considering feasibility study 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		

Question 10

The Consumer Protection Act 1987 is an example of legislation put in place to protect consumers.

Evaluate how effectively and thoroughly consumers are protected by legislation. [12]

Q10	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c			
					6			6			12

Candidates should provide evidence of either appraisal and/or making judgements and applying this to be awarded up to 12 marks based on:

Discussion may include the following points:

Relevant wider issues may take into account some of the following points:

- Application of industry standards and checks. Candidates may link standards issued by BSI or ISO to legislation.
- The role consumer groups such as Which? Or NCF (National Consumer Federation) play in making and/or changing legislation and campaigning for positive change.

Information below is comprehensive content, it is not expected that the candidate will discuss each piece of legislation in this much detail in order to gain credit in the top mark band.

The Consumer Protection Act 1987 protects consumers in the following ways

- The Consumer Protection Act 1987 gives consumers the right to claim compensation against the producer of a defective product if it has caused damage, death or personal injury. Thus giving the consumer confidence that designers and manufacturers have followed due diligence when testing the safety of their products.
- A product for the purposes of the Consumer Protection Act can be almost anything that can be packaged and sold. This gives the consumer 'all round' protection when considering purchase of new products.
- There is a strict liability test for defective products in UK Law making the producer of that product automatically liable for any damage caused. This places the emphasis on the producer and giving the consumer peace of mind.
- Damage is established when there has been 'any damage', this means that anyone who suffers damage as a result of the defect is entitled to claim, not just the person who bought it thus protecting the range of users/consumers who may come into contact with the product.
- Exclusions include loss or damage to the product itself
- Companies can try and defend the claim by proving the following, but the onus is on them to prove these conditions, removing burden of proof from consumer:
 - a) The producer didn't sell or supply the product. For example, if the only version of that product had been stolen and had never been intended for public sale.
 - b) The product wasn't defective when the producer supplied it
 - c) At the time of production the level of scientific and technical knowledge wasn't advanced enough to have known about the defect in the product
 - d) The defect is present because of a need to comply with legal requirements
 - e) The product wasn't the operative cause of the damage or personal injury.

The Consumer Rights Act 2015 could also be discussed

- The Consumer Rights Act 2015 became law on 1 October 2015, replacing three major pieces of consumer legislation - the Sale of Goods Act, Unfair Terms in Consumer Contracts Regulations, and the Supply of Goods and Services Act. It was introduced to simplify, strengthen and modernise the law, giving the consumer clearer shopping rights.
- As with the Sale of Goods Act, under the Consumer Rights Act all products must be of satisfactory quality, fit for purpose and as described. The consumer should be able to have confidence that the supplied goods fit this criteria.
- The rules also include digital content in this definition. So all products – whether physical or digital - must meet the following standards in order to protect the consumer:
 - a) **Satisfactory quality** Goods shouldn't be faulty or damaged when they are received. The question is asked; what a reasonable person would consider satisfactory for the goods in question. For example, bargain-bucket products won't be held to as high standards as luxury goods.
 - b) **Fit for purpose** The goods should be fit for the purpose they are supplied for, as well as any specific purpose made known to the retailer before agreeing to buy the goods.
 - c) **As described** The goods supplied must match any description given, or any models or samples shown at the time of purchase.
- Under the Consumer Rights Act consumers have a legal right to reject goods that are of unsatisfactory quality, unfit for purpose or not as described, and get a full refund - as long as this is done quickly. This allows consumer to return goods that are of unsatisfactory quality
- This right is limited to 30 days from the date ownership is taken of the product. After 30 days, the consumer is not legally entitled to a refund
- This right to a refund doesn't apply to products bought as downloads, though - such as music, games or apps.
- Consumers can, however, ask for a digital product to be repaired or replaced if it develops a fault. And if this isn't possible, or is unsuccessful, consumers have the right to receive a price reduction.

Trade Descriptions Act

- The Trade Descriptions Act 1968 made it an offence for businesses or salespeople to sell a product or service based on misinformation. The Act forced them to be more truthful about their service or product and not deliberately mislead consumers into spending their money on a false claim.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 1c
3	5-6	Excellent evaluation of consumer protection affecting the supply of products. A thorough discussion, which appraises and/or makes judgements about the effectiveness of consumer protection rights. Well-considered, relevant wider issues used as a context for the discussion.	5-6	Applies a thorough knowledge and understanding of technical principles applied to consumer protection. 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 consumer protection affecting the supply of products. A generally sound discussion, which appraises and/or makes judgements about the consumer protection rights. Generally well-considered, relevant issues used as a context for the discussion.	3-4	Applies a generally sound knowledge and understanding of technical principles applied to consumer protection. 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 consumer protection affecting the supply of products. Little evidence of appraising or making judgements about the consumer protection rights. Few issues are identified.	1-2	Applies a basic knowledge and understanding of technical principles applied to consumer protection.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		