



GCSE MARKING SCHEME

SUMMER 2025

**DESIGN AND TECHNOLOGY – COMPONENT 1
C600U10-1**

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 GCSE DESIGN & TECHNOLOGY – COMPONENT 1

SUMMER 2025 MARK SCHEME

Guidance for examiners

Positive marking

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

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

Banded mark schemes

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

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

In order to reach the highest levels of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that it contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded. For each question, descriptors will indicate the different skills and qualities at the appropriate level.

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

Stage 1 – Deciding on the band

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

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

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

Stage 2 – Deciding on the mark

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

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

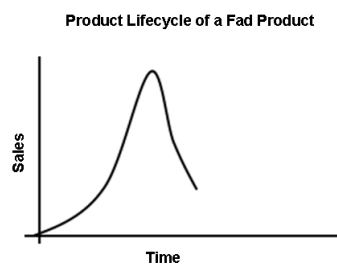
SECTION A

Answer **all** questions

This question is about Design and Technology and our world.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
1. (a) (i)		1	The bar chart below compares the percentages of material waste recycled in the United Kingdom (UK) in 2021 and 2023. State the percentage of wood that was recycled in 2021. [1] Award one mark for correct response: 40% <i>Only acceptable response.</i>	AO4 1a [1]	1
(ii)		3	Calculate the total percentage of material waste recycled in 2023 as a fraction in its lowest form. [3] <i>Show all workings.</i> Award one mark to be awarded for each correct step in the calculation. 76% + 76% + 43% + 45% = 240% (1) $240/4 = 60$ (1) $\frac{60}{100} = \frac{3}{5}$ (1) Note: Full marks can only be awarded with workings/calculations shown. <i>Credit any appropriate calculation approach.</i>	AO4 1c [3]	3

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
1. (b) (i)			The images below show a selection of fad products. Describe the term fad product. [2] Up to two marks to be awarded for a clear description of a fad product. For example: • A fad product is one where sales of the product increase very rapidly (1) but are subsequently followed by a rapid decline in sales as popularity wains. (1) • Fad products are characterised by high adoption from the market place with a rapid increase in sales. (1) Obsolescence takes place as sales decline rapidly. (1) • A fad product is short-lived. (1) • A fad product receives much attention in the market place and sales grow rapidly. (1) • A fad product has intense popularity (1) but this is short-lived/temporary. (1) <i>Credit any other appropriate response.</i>	AO4 1c [2]	2
(ii)			The demand for fad products is influenced by market pull. State the meaning of the term market pull. [1] For example: Market pull is when a new product is produced in response to demand from the market/users. (1) <i>Credit any other appropriate response.</i>	AO4 1a [1]	1

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
1. (b) (iii)			In the space below, draw and label a graph to show the product lifecycle of a fad product. [3] Up to three marks to be awarded for correctly: - Constructing and labelling axis. (1) - Drawing appropriate lifecycle of fad product, with limited, if any maturity stage. (1) - Showing the sharp growth and/or sharp decline. (1) Credit can be given for drawing/identifying the lifecycle of a fad product within the introductory stage only. No marks to be awarded for a typical/bell curve Product Lifecycle graph. <i>Only acceptable response.</i> 	AO4 1b [3]	3
				Total	10

This question is about smart, composite and technical materials.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
2. (a) (i)	✓		Composites combine the properties of two or more materials. GRP is an example of a composite material. State the meaning of GRP. [1] Award 1 mark for correct answer. Answer: Glass Reinforced Plastic. Accept: Glass Reinforced Polymer / Plastic or Polyester. <i>Only acceptable responses.</i>	AO4 1a [1]	1
(ii)	✓		Carbon fibre is a composite material used to manufacture high-performance sports equipment as shown below. Describe <u>one</u> property of carbon fibre that makes it suitable for high-performance sports equipment. [2] Up to two marks are to be awarded for a description. A maximum of one mark is to be awarded for simply listing a suitable property of carbon fibre. For example: Carbon fibre is incredibly strong yet light in weight (1) which makes it comfortable and protective when used for a sports helmet. (1) Properties of carbon fibre suitable for high-performance sports equipment include: • High-strength (1) • Low density (1) • Good corrosion resistance (1) and • Fatigue performance (1) compared to other metal alloys. (1) • Low abrasion properties (1) which prolong the life/effectiveness of sports equipment such as hockey sticks (1) <i>Credit any other appropriate response.</i>	AO4 1b [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
2. (a) (iii)	✓		Explain why designers might avoid using composite materials for modern day sports equipment. [3] Up to three marks are to be awarded for a clear explanation. A maximum of one mark is to be awarded for simply listing suitable reason(s) designers would avoid using composite materials for modern sports equipment. For example: Composite materials are time-consuming to manufacture (1). Cutting and shaping composites after forming is often difficult due to their strength (1) making them expensive products for consumers to purchase. (1) Composite materials are made from two materials that once combined are difficult to recycle (1). This means composite materials are not environmental choices (1) and often end up in landfill on disposal. (1) Other disadvantages of composite materials: • High production costs; • Fragile compared to other metals/poor-modest impact resistant; • Difficult and/or expensive to repair; • Curing composite materials can take up to 10 hours; • Specialist equipment needed for manufacture; • High-quality moulds are required for a smooth product finish; • Many composites are vulnerable at high temperatures and can release toxic (micro) particles and fumes into the air, and are a health risk; • May give unfair advantage in a competitive sporting event. <i>Credit any other appropriate response.</i>	AO4 1c [1] AO4 2c [2]	3

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
2. (b) (i)	✓		The body of the kettle shown in the pictures below is made from a smart material. As the water boils, the kettle changes colour. State the name of the smart material used for the kettle body. [1] Answer: Thermochromic <i>Only acceptable response.</i>	AO4 1c [1]	1
(ii)	✓		Discuss why consumers would purchase a kettle that changes colour when in use. [3] Up to three marks to be awarded for a clear discussion. A maximum of one mark to be awarded for simply listing one suitable reason consumers would purchase a kettle that changes colour when in use. A maximum of two marks to be awarded for multiple reasons without a clear discussion. The full 3 marks can be awarded for a discussion which provides a reason/s of the impact this has making the customer choose the kettle. For example: Changing colour is useful as it indicates the water in the kettle is still hot (1) and doesn't need to be heated (1). In the long-term, it could save on electricity bills. (1) Changing colour on boiling acts as a safety feature (1) warning the consumer of the temperature of the water inside the kettle (1) preventing accidental burns. (1) Other reasons for purchasing a kettle that changes colour when in use: • Novel product; • For aesthetic purposes; • Child safety/educational; • Can be used to heat water needed for a lower temperature/can be switched off before boiling. <i>Credit any other appropriate response.</i>	AO3 2a [3]	3
				Total	10

This question is about electrical systems, programmable components and mechanical devices.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total								
3. (a) (i)	✓		The picture below is of an electric bicycle that has many moving parts and converts different types of motion when in use. Using examples of other products, complete the table below by naming a product that uses each of the motions listed. 3 x [1] Award one mark for one product that correctly uses each motion listed. <table><tr><th>Motion</th><th>Product</th></tr><tr><td>Linear</td><td>For example: a sliding drawer/door, automatic doors, a train, lifts, adjustable products, e.g. desk height.</td></tr><tr><td>Reciprocating</td><td>For example: a sewing machine needle, pump (e.g. bicycle), a piston, a door bell ringer, a saw (to cut wood), CAM toys.</td></tr><tr><td>Oscillating</td><td>For example: a swing, clock pendulum, an electric toothbrush.</td></tr></table> <i>Credit any other appropriate response.</i>	Motion	Product	Linear	For example: a sliding drawer/door, automatic doors, a train, lifts, adjustable products, e.g. desk height.	Reciprocating	For example: a sewing machine needle, pump (e.g. bicycle), a piston, a door bell ringer, a saw (to cut wood), CAM toys.	Oscillating	For example: a swing, clock pendulum, an electric toothbrush.	AO4 1b [3]	3
Motion	Product												
Linear	For example: a sliding drawer/door, automatic doors, a train, lifts, adjustable products, e.g. desk height.												
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Oscillating	For example: a swing, clock pendulum, an electric toothbrush.												
(ii)	✓		A bicycle brake system uses a bell crank lever. State the function of a bell crank lever. [1] Award one mark for a simple description of a bell crank. For example: A bell crank changes the direction of a motion (including corners). (1) <i>Credit any other appropriate response.</i>	AO4 1c [1]	1								

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
3. (b) (i)	✓	1	The picture below shows the gear system of the electric bicycle. The driven wheel of the bicycle's gear system has 10 teeth and the driver wheel has 40 teeth. State how many rotations the driven gear makes if the driver gear rotates once. [1] Answer: $40/10 = 4$ rotations <i>Only acceptable answer.</i>	AO4 1b [1]	1
(ii)	✓	3	The diameter of the bike's wheel is 60cm. Calculate the distance in <u>metres</u> the electric bicycle will travel after ten rotations. <i>Show all workings.</i> [3] Award one mark for each correct step in the calculation. Either method of calculation should be credited. Answer 1: $10 \times 4 = 40$ rotations (1) $\pi d = 3.142 \times 0.6\text{m} = 1.89\text{m}$ (1) $1.89\text{m} \times 40 = 75.6\text{m}$ or 76m (1) Accept any numerical number between 75 and 76m OR Answer 2: $10/4 = 2.5$ rotations (1) Circumference = $\pi d = \pi \times 60 = 188.5$ (1) Distance = $10 \times 188.5 = 1885/100 = 18.85\text{m}$ (1) <i>Credit any appropriate approach to correct calculation.</i>	AO4 1c [3]	3

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(iii)			Other than cost, explain why a cyclist would buy a non-electric bicycle instead of an electric one. [2] Award one mark for an appropriate reason a cyclist would choose a mechanical bicycle instead of an electric one. Full marks can be awarded if the reason provided is explained. For example: A regular bicycle is lighter-in-weight (1) than an electric one which makes carrying the bike easier/less strength is needed. (1) Other examples: • Bicycle is only needed for fitness and user wants the challenge. • Regular bikes need less maintenance. • No battery that needs charging. • Electric bikes are more desirable and are at greater risk of being stolen. • Fewer regulations to abide by than electric bikes. • Sustainability issues – battery / lithium / ion / disposal. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2
3. (c)	✓		A microcontroller is a key component of electric bicycles. Define the meaning of the term microcontroller and explain how they can be used in electric bicycles.[5] Award one mark for a simple definition of a microcontroller. For example: • A microcontroller can be programmed to perform different processing functions. • A microcontroller is an example of a single-board computer (SBC) (and is manufactured as an integrated circuit (IC)). • A microcontroller can store information. • A microcontroller is a control device which incorporates a microprocessor. • A microcontroller includes a single chip's processor, memory and input/output peripherals.	AO4 1b [4] AO4 2b [1]	5

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
			Award up to 4 marks explaining how microcontroller(s) can be used in electric bicycles. For example: Microcontrollers can be programmed with sensors that identify how much battery life remains (1). This provides information to the cyclist to gauge how much further they can travel without running out of battery power (1). A microcontroller can display the time (1), a safer option for the cyclists as it will be in clear sight. (1) Microcontrollers can: • Drive/power the bike's motor. • Control the throttle. • Control brake light. • Control headlights and directional lighting. • Can display information via LED/LCDs e.g., battery life. • Measure temperatures. • Monitor battery life. • Identify/control the speed of bike. • Control acceleration. • Control amount of assist/pedal activity. • Measure distance travelled. • It can give warning messages/error signs. • Can detect obstacles. • Be anti-theft sensors. <i>Credit any other appropriate response.</i>		
				Total	15

This question is about materials.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
4.(a) (i)			The image below shows a paper lampshade for child's bedroom. The weight of paper is measured in grams per square metre (gsm). Underline the weight of paper most suitable for the lampshade. [1] <u>35 gsm</u> 170 gsm Award one mark for correct response. <i>Only appropriate response accepted.</i>	AO4 1a [1]	1
(ii)			Other than cost, state one reason for paper being chosen as a material for the lampshade. [1] One mark for an appropriate answer. For example: • Paper is translucent (1) • Defuses light (1) • Can be dyed any colour (1) • Can be printed in any pattern (1) • Lightweight (1) • Can be recycled (1) <i>Credit any other appropriate response.</i>	AO4 1a [1]	1

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
4. (a) (iii)			Explain how the lampshade design could be improved to be used in a child's bedroom. [2] A maximum of one mark for a suitable suggestion to make the lampshade more suitable for a child's bedroom, and an additional mark for an explanation. For example: The lampshade could be dyed a bright, gender-neutral colour (1) to compliment the colours of any bedroom (walls/furniture). (1) Change: • Shape to be more interesting, such as a cuboid. • Printed pattern for aesthetic appeal. • Words/shapes printed could be added for educational purposes. • A pattern can be cut into paper to emit more light. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2
(b) (i)	✓		The storage box in the image below has been made from brass and polyvinyl chloride (PVC). Brass is an alloy. Identify the two primary metals that brass contains. 2 x [1] One mark for each correct answer: Primary Metal 1: Copper (1) Primary Metal 2: Zinc (1) <i>Only acceptable responses.</i>	AO4 1a [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total						
4. (b) (ii)	✓		The storage box is to be kept in the bathroom. Identify one different property for each material that makes it suitable for the storage box. 2 x [1] One mark for each correct answer. Note: the property identified must be relevant to either the design of the storage box or the bathroom environment. Brass: corrosion resistant, tarnish resistant, malleable/ductile, durable, tough, can be polished for shine. PVC: impact resistant, light in weight (than glass), resistant to a range of chemicals/detergents, doesn't corrode, durable, bonds well with adhesives/solvents, is transparent, is difficult to shatter. <i>Credit any other appropriate response.</i>	AO4 1c [2]	2						
(c) (i)	✓		The puffer jacket pictured below is made from a nylon microfibre material. [6] Put one tick (✓) in the table below to identify whether nylon is a natural or synthetic material. [1] <table><tr><td></td><td>Natural</td><td>Synthetic</td></tr><tr><td>Nylon</td><td></td><td>✓</td></tr></table> <i>Only acceptable response.</i>		Natural	Synthetic	Nylon		✓	AO4 1a [1]	1
	Natural	Synthetic									
Nylon		✓									

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
4. (c) (ii)	✓		Define the term microfibre. [1] One mark to be awarded for a simple definition. A microfibre is: • A <u>very/exceptionally fine</u> fibre (do not accept just 'fine fibre' or 'small fibre'). • A fibre 60-100 times finer than a human hair. • A fibre with a diameter of less than 10 micrometres. • A fibre engineered for specific functions. Accept responses that highlight with contextual clarity the properties of a microfibre. <i>Credit any other appropriate response.</i>	AO4 2a [1]	1
(iii)	✓		Evaluate the properties of nylon that make it a suitable material for the puffer jacket. [4] Award a maximum of two marks for identifying suitable properties of nylon. Full marks can be awarded if two suitable properties have been justified and related to the puffer jacket. Negative properties of nylon, if appropriate, should be awarded up to full marks with justifications. For example: Nylon is a water-resistant (accept waterproof) material (1) that will keep the wearer dry if caught in a rain shower (1). It is hard wearing (1) which means the jacket will last and can be worn for years (1) (and is therefore better for the environment).	AO4 1c [4]	4

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
			Other positive properties of nylon material: • Has good tensile strength. • Light-in-weight. • Washes easily. • Dries quickly (not absorbent). • Resistant to chemicals and perspiration. • Has a lustrous appearance. • Has good dimensional stability – will not deform or lose shape. • Is insulating (due to the fine weave when woven). • Abrasion resistant. • Can be dyed any colour. Note 1: Nylon is waterproof but when woven into a fabric it becomes water resistant due to the gaps between the warp and weft yarns. Accept any reference to nylon being waterproof and/or water resistant. <i>Credit any other appropriate response.</i> Negative properties of nylon material: • Poor resistance to sunlight – colour will fade • Heat sensitive/will melt • Static • Is deemed as a poor environmental choice as it is made from non-renewable resources. However, being durable and hard-wearing can be seen as an advantage to long life. Note 2: Nylon fabric is fine so a consequence is the weave is 'tight' and can trap air to give an insulation affect.		
4. (c) (iv)			The puffer jacket contains an internal layer of non-woven fibres. Describe how this layer benefits the user of the puffer jacket. [2] One mark for an appropriate benefit to the user of the puffer jacket. Full marks should be awarded for a clear description of the appropriate benefit identified. For example: Non-woven fibres act as an insulation layer (1), they trap air which warms the body of the user (1). <i>Credit any other appropriate response.</i>	AO4 1c [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
4. (d) (i)			The picture below shows sawn timber. Timber is sold in a variety of stock forms. Identify one stock form. [1] One mark for a correct answer. Stock forms of timber: plank, board, strip, square, moulding, sheet or dowel. <i>Credit any other appropriate response.</i>	AO4 1b [1]	1
(ii)			Timber is identified using a range of discriminators. Describe the discriminators of wood which are considered when products are newly designed. [3] One mark for a maximum of two discriminators identified. Full marks should be awarded for an appropriate description. For example: A designer would consider both the colour (1) and the grain (1) of timber when designing a product that needs an aesthetic appearance to stand out. (1) Discriminators of timber: Aesthetics; Mechanical; Environmental; Economic Aesthetic: colour, grain, texture, finish, knots Mechanical: weight, grain, durability, ease of working, strength, hardness, elasticity, dimensional stability, shaping/drilling, moisture content Environmental: supply chain, able to be recycled Economic: cost, supply chain <i>Credit any other appropriate response.</i>	AO4 1c [3]	3
				Total	20

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (a) (i)			State one anthropometric consideration for your chosen product. [1] One mark for identifying a suitable anthropometric consideration. Anthropometrics is the study of the sizes of people in relation to the product being used. Therefore, the answer provided should relate appropriately to the selected product's size, shape or form. For example: Cotton towel – any reference to size/shape of towel to be used to dry the body easily. Paper plates, bowls and cups – any reference to size/shape/form that helps user access food/drink. Plastic cutlery – any reference to hand/mouth size to be able to hold/eat easily using cutlery. Metal folding chair – any reference to height, width or depth of chair in relation to body measurements. LED portable lamp – any reference to hand size to carry/switch on/off a portable lamp. Timber picnic bench – any reference to height/size of user's body to be able to sit comfortably at/on table. Reference may be made to the product's portability in relation to size, which should be credited if appropriate. <i>Credit any other appropriate response.</i>	AO4 1a [1]	1

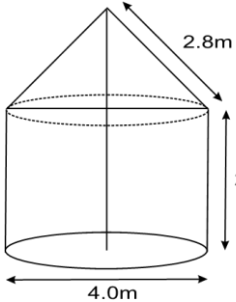
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (a) (ii)			Describe how the chosen product could be made more attractive to the user. [3] One mark for each suggestion that would improve the appearance of the selected product/make it more attractive, up to a maximum of two marks. An additional mark can be awarded for a clear description. Full marks can be awarded for a detailed description for just one suggestion. Ensure answers provided relate to the camping product selected. For example: the towel could be dyed bright (yellow). (1) This would make the towel stand out (1) so it can't be lost if used on the beach. (1) Reference may be made to: • Colour • Print and pattern • Finish (to improve experience) • Safety • 'Attraction' to purchase considerations, e.g. comfort <i>Credit any other appropriate response.</i>	AO4 1c [3]	3

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (b)			Describe how your chosen product is suitable for use when camping. [2] One mark for identifying a correct suitable function/reason for products camping suitability. An additional mark should be awarded for a clear description. For example: paper plates are disposable (1), limiting what needs to be transported/stored, saving space (1). For example: <u>Cotton towel</u> To dry body; dries body quickly as absorbent; covers body at beach; lie on. <u>Paper plates, bowls and cups</u> To hold food safely/securely; disposable; stacks easily for travelling/picnics; easily found/cheap. <u>Plastic cutlery</u> To cut/hold food safely; disposable; easily found/cheap; safe for children as not sharp; easy to clean; portability. <u>Metal folding chair</u> To sit on outdoors/comfortably; folds making it easy to stack/store; can be wiped clean (if gets wet); easy to carry to the beach. Secondary Function: plant stand, a stool. <u>LED portable lamp</u> To shine light at night; can be safely used to add light inside a tent; economical to run for camping; compact/easy to carry/store. <u>Timber picnic bench</u> To sit on/at; good size for whole family to sit around/socialise; safe as robust and heavy; can be used to prepare food/play games on that take place when camping. <i>Credit any other appropriate response.</i>	AO4 2a [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (c)			Explain the reasons why exploded diagrams are included in detailed final design drawings. [3] A maximum of one mark for just stating a reason(s) for including exploded diagrams in detailed final design sketches. Two reasons required, with a clear explanation for full marks. For example: Exploded diagrams help the designer communicate their design thinking (1). For example, they can show decorative detailing (1) difficult to see if not drawn as an exploded diagram (1). Reference may be made to: • Explains how parts of a design may fit together. • Reveals details and nuances that otherwise would be hidden. • Helps explain aspects of a design that the reader may not understand otherwise. • Takes the place of written instructions. • Shows constructional detailing/assembly. • Shows decorative/embellishment detailing. • Can be used for self-assembly furniture/instruction. <i>Credit any other appropriate response.</i>	AO4 2a [3]	3

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (d) (i)			Camping products are usually seasonal and manufactured using batch production. Describe one environmental consequence of seasonal products. [2] One mark for a correct environmental consequence. Two marks to be awarded for a clear description. For example: • Products get thrown away at the end of the season when not needed (1), increasing landfill damaging/affecting the eco-system. (1) • Products are often made from synthetic materials, derived from fossil fuels, as they are cheap (1) – this is environmentally damaging as fossil fuels cannot be replaced, they are non-renewable. (1) • Natural materials are grown, and are aesthetically pleasing but often require help from pesticides/fertilisers to grow (1), unless organic, these damage the soil and the eco-system living there. (1) • Seasonal products are often cheap and designed to be disposable/not last long (1). They can be recycled but are often left where used for others to remove. (1) <i>Credit any other appropriate response.</i>	AO3 2b [2]	2

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (d) (ii)			Analyse the benefits of using batch production for seasonal products. [4] Award a maximum of two marks for identifying suitable benefits of batch production. Full marks can be awarded if two suitable benefits have been justified and related to batch production. A negative benefit of batch production, if discussed, should be credited if appropriate. Benefits to batch production: • Batch production allows for smaller runs of a product (or extended product runs if product proves popular). • Products made are identical. • Changes/variations can be made relatively easily (to meet the need of a larger target audience) and ensure product meets seasonal demands. • Cheaper to produce a batch of a product than a single item at any one time. Although is more expensive than producing a product on mass. • Reduces the business risk associated with producing just one product (as in mass manufacture). • The work force tends to be skilled in one area, which helps with efficient production and quality control. • Reduced labour costs (less skilled workforce get paid less money). • Machines can be tailored to demand and to change in product. • Materials can be bought in bulk, reducing manufacturing costs (economies of scale). <i>Credit any other appropriate response.</i>	AO3 2b [4]	4

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (e)		5	 The diagram below shows an outline of a camping tent. A conical shape tops the cylinder section. Calculate the area of the material used for the camping tent. Assume there is no material at the base of the tent. <i>Show all workings.</i> [5] One mark to be awarded for each correct process in the calculation, up to a maximum of 3 marks. 5 marks to be awarded for correct answer with all correct workings shown. A maximum of three marks for correct answer with little or no evidence of calculation. Height of cylinder = 2.1m Diameter of cylinder = 4m Radius of cylinder = 2m Slant height of conical shape = 2.8m SA = Surface Area Area of material used = SA of conical part + SA of cylindrical part. $= \pi r l + 2\pi r h$ (1) $\pi r l = \pi(2 \times 2.8) = 17.59\text{m}^2$ (1) $2\pi r h = 2\pi(2 \times 2.1)$ (1) $= 6.28 \times 4.2 = 26.38\text{m}^2$ (1) Answer: $17.59\text{m}^2 + 26.38\text{m}^2 = 43.97\text{m}^2$ or 44m² (1) <i>Credit any appropriate approach to calculation.</i>	AO4 1a [1] AO4 1b [4]	5
				Total	20

SECTION B

Question 6: Electronic systems, programmable components and mechanical devices

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The picture below is of a component used in a portable speaker. State the name of the component. [1] <i>Answer:</i> Polarised capacitor, electrolytic capacitor or capacitor <i>No not accept:</i> ceramic capacitor	AO4 1a [1]	1
(ii)			A component on the speaker's circuit board is shown below. State the name of the method used to populate the circuit board. [1] <i>Answer:</i> Through hole soldering (accept soldering)	AO4 1b [1]	1
(iii)			The speaker's circuit board is cut using a guillotine. Describe one advantage of using a guillotine to cut the circuit board. [2] Award 1 mark for identifying an advantage and an additional mark for providing a description. For example: Cutting with a guillotine avoids rough edges that result from using a band saw. <i>Answers provided may include:</i> 1. The dust generated for cutting a circuit board using a band saw can also cause skin irritation; 2. Using a manual saw can easily/accidentally scratch the Photoresist coating; 3. Using a guillotine gives a clean edge to the circuit board; 4. Cutting with a guillotine avoids harmful dust; 5. When cutting a circuit board with a band saw or circular saw the blades will become dull or blunt very quickly. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
6. (a) (iv)			In the space below, use words and sketches to show how a printed circuit board (PCB) can be made in school. [5] Award up to 5 marks for <i>both</i> words and sketches that demonstrate a clear understanding of the stages needed to make a circuit board in school. Award a maximum of 3 marks if only accurate words or sketches are provided. <i>Answers provided may include:</i> 1. Design the circuit using a software package. (1) 2. Export the file to a suitable software and engraver. (1) 3. Print the circuit in mirror format on a laser printer. (1) 4. Place the printed image (print side down) onto the copper-clad board. (1) 5. Iron the paper into the board using a hot iron. (1) 6. Soak the paper away from the board. (1) 7. Immerse the board into an acid bath. (1) 8. Clean off the toner. (1) Or 1. Create a PCB design. (1) 2. Print out the design onto the shiny side of the transfer paper. (1) 3. Sand the copper plate so the design has a rough surface to stick to when transferred. (1) 4. Wash the copper with some water and rubbing alcohol and let it dry. (1) 5. Cut out the designs and place them face down on the copper. (1) 6. Run the copper plate with the design face down through a laminator or iron 5-7 times until the plate is hot. 7. Place the plate into a cold bath and agitate until the paper floats off. (1) 8. Place the PCB into the etching solution and agitate for 25-30 minutes or until all the copper has dissolved around the design. (1) 9. Once all the copper is gone, rinse it in the water bath, let it dry, and use rubbing alcohol to whip off the ink transferred onto the PCB. (1) 10. Drill the holes. (1)	AO4 2c [5]	5

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
			Credit should be given for quality control checks included within the response. For example, holes or gaps in the transfer should be checked prior to using the acid bath, and a mirror image of the PCB layout should be used with the photo-etch method. <i>Credit any other appropriate process that accurately shows how to produce a circuit board when made in school.</i>		
6. (b) (i)		5	The copper board used to make the circuit boards costs £6.00 per board (300mm x 450mm). Each circuit board measures 30mm x 45mm. Calculate the cost of the copper board required to manufacture a batch of 750 circuit boards. Show all workings [2] $750 \div 100 = 7.5$ (1) 8 sheets. $8 \times £6.00 = £48$. (1) Also accept that candidates may provide responses of actual cost of the boards required (not whole boards): $750 \div 100 = 7.5$ (1) 7.5 sheets. $7.5 \times £6.00 = £45$ (1)	AO4 1b [3] AO4 1c [2]	5
(ii)			The speaker's selling price is 500% higher than the cost of the circuit board. Calculate the selling price of the speaker. [1] $£48 \div 750 = £0.064 \times 5.0 = 0.32p$ (1) Or $£45 \div 750 = £0.06 \times 5.0 = 0.30p$ (1) (Do not penalise if candidates use either response from b (i))		

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
(iii)			The cost of the copper board is reduced by $\frac{2}{5}$th. Calculate the new cost of the copper board to 2 decimal places. Show all workings. [2] $\pounds 6.00 \div 5 = \pounds 1.20$. $\pounds 1.20 \times 2 = \pounds 2.40$ (1) $\pounds 6.00 - \pounds 2.40 = \pounds 3.60$ (1) <i>Do not penalise errors carried forward from 6. (b) (i)</i> <i>Credit any other appropriate approach to the calculations.</i>		

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total															
6. (c)			Analyse the benefits of using automated machinery to manufacture printed circuit boards compared to printed circuit boards made by hand. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the benefits of using automated machinery to manufacture printed circuit boards compared to printed circuit boards made by hand. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the benefits of using automated machinery to manufacture printed circuit boards compared to printed circuit boards made by hand. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the benefits of using automated machinery to manufacture printed circuit boards compared to printed circuit boards made by hand. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table>		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the benefits of using automated machinery to manufacture printed circuit boards compared to printed circuit boards made by hand. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the benefits of using automated machinery to manufacture printed circuit boards compared to printed circuit boards made by hand. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the benefits of using automated machinery to manufacture printed circuit boards compared to printed circuit boards made by hand. There will be limited evidence of relevant examples or a logical chain of reasoning.	1		Award 0 marks for incorrect or irrelevant answers		AO3 2a [5]	5
	AO3 2a 5 marks																			
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	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
			Indicative content This content is not prescriptive, and candidates are not expected to refer to all the points identified below. <i>Answers must analyse the benefits of using automated machinery to manufacture printed circuit boards compared to printed circuit boards made by hand to access the full 5 marks.</i> Automated assembly guarantees speed, efficiency, minimal errors, cost efficiency, and miniaturization. On the other hand, manual PCB assembly comes in handy to save on cost when handling low-volume tasks. In addition, if you want to clean up the process, assemble unusual components, or repair a malfunction, manual assembly is the best option. Benefits of automated PCB manufacture: • Minimal Errors: An automated PCB assembly service relies on computer programs to execute most processes. As a result, it reduces errors and ensures all products meet the set industry standards. • Cost Reduction: A significant reduction in errors means an equal reduction in production cost. • Miniaturisation: Through automation, you can use computer programs to design and produce smaller components that fit within the smallest spaces of the product. • Speedy and Efficient Production: Computer programs work faster and can meet tight deadlines, unlike humans. As such, it can help you handle mass production. • Higher quality: Because an automated machine is designed and programmed to perform a specific task repeatedly, circuit board accuracy and quality can be consistently better than hand assembly. • Because of the automated assembly, fewer employees are required for the task. Fewer employees can result in financial savings for the assembler, lowering the cost of PCB production. • An automated PCB assembly service ensures that the boards are delivered in high-quality conditions while allowing you to complete numerous stages concurrently. • Automated services are far more effective than hand assembly in delivering timely and consistent boards while remaining cost-effective when it comes to mass production of PCBs.		

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total									
			Manual PCB manufacture: • Cost-effective for Smaller Productions: Manual PCB assembly service is particularly cost-effective when working on low-volume projects. • Enables unusual component placement: Manual PCB assembly is the best alternative for fixing unique equipment parts on circuit boards. • Prototype projects mainly work well on a manual PCB assembly service. • You can also use manual assembly for last-minute electronic components that didn't arrive on time. • The quality of your final product depends on thorough inspection and cleaning of hidden parts after assembly. However, sometimes it isn't easy to inspect every component through automated systems. • You can't use computer programs to repair a fault in moving parts. Computer programs can troubleshoot problems in the system, but you need technicians to handle repair work. <i>Credit any other appropriate response.</i>											
6. (d)			Evaluate the reasons the designer uses CAD software to model the speaker circuit compared to physically making the circuit. [6] Band descriptors and mark allocations <table><tr><th></th><th colspan="2">AO3 2b 6 marks</th></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the reasons the designer uses CAD software to model the speaker circuit compared to physically making the circuit. There will be evidence of relevant examples and well-developed substantiated judgments in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the reasons the designer uses CAD software to model the speaker circuit compared to physically making the circuit. There will be some evidence of mostly relevant examples and partly substantiated judgments in a response which is generally well structured.</td><td>3-4</td></tr></table>		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the reasons the designer uses CAD software to model the speaker circuit compared to physically making the circuit. There will be evidence of relevant examples and well-developed substantiated judgments in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the reasons the designer uses CAD software to model the speaker circuit compared to physically making the circuit. There will be some evidence of mostly relevant examples and partly substantiated judgments in a response which is generally well structured.	3-4	AO3 2b [6]	6
	AO3 2b 6 marks													
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Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme			AO	Total						
			<table><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding when evaluating the reasons, the reasons the designer uses CAD software to model the speaker circuit compared to physically making the circuit. There will be limited evidence of relevant examples or judgments in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td colspan="3">Award 0 marks for incorrect or irrelevant answers</td></tr></table>	BAND 1	Answer demonstrates only basic knowledge and understanding when evaluating the reasons, the reasons the designer uses CAD software to model the speaker circuit compared to physically making the circuit. There will be limited evidence of relevant examples or judgments in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers						
BAND 1	Answer demonstrates only basic knowledge and understanding when evaluating the reasons, the reasons the designer uses CAD software to model the speaker circuit compared to physically making the circuit. There will be limited evidence of relevant examples or judgments in a response which demonstrates little structure.	1-2											
Award 0 marks for incorrect or irrelevant answers													
Indicative content This content is not prescriptive, and candidates are not expected to refer to all the material identified below. <i>Answers must evaluate the use of CAD software to model the speaker circuit and compare this to physically making the circuit to access the full five marks.</i> Advantages of using CAD software to model circuits: • Saves time: Using the computer-aided design software saves time. A better and more efficient circuit can be designed in a shorter time. • Easy to edit: When using computer-aided design software, it will be much easier to make changes to the circuit. Errors can be fixed, and circuit drawings can be easily modified. • Decrease in error percentage: As the CAD software uses some of the best tools, the rate of error that occurs because of manually making the circuit is significantly reduced. • Easy to share: The CAD tools make it easier to save the files and store them in a way that you can use them repeatedly and share them without any unwanted hassles. • Improved accuracy: CAD software will offer accuracy that can never be achieved by opting for manually made circuits. CAD tools measure the precision, skill and accuracy level of the designs. • Virtual modelling allows you to test the circuit against varying voltages and currents.													

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
			Disadvantages of using CAD software to model circuits: • Work can be lost because of the sudden breakdown of computers. • Work is prone to viruses. • Work could be easily “hacked.” • Time-taking process to know how to operate or run the software. • Need for regular updating of software or operating systems. • Needs less employment because of CAD/CAM systems Advantages of physically making the circuit models: • Prototype Testing. Physically making the circuit allows the designer to test if the electronic system works as intended before final production, reducing the risk of failure. • Design Validation. Building the circuit helps confirm that component values, layout, and functions match the design specification, allowing the designer to refine or adjust ideas. • Troubleshooting Opportunities. It enables the designer to identify practical issues such as loose connections, short circuits, or incorrect polarity—problems that may not be obvious in theoretical designs. • Enhanced Creativity. Seeing the circuit in action can inspire further design development or innovation, particularly when it is integrated into a product’s form or function. Disadvantages of physically making the circuit models: • Time Constraints. Physically assembling a circuit takes time, which may limit the number of iterations or prototypes a designer can produce, especially in a coursework or timed project setting. • Material and Component Costs. Designers must source and purchase electronic components, which can increase project costs—particularly if components are damaged or wasted during testing. • Risk of Technical Errors. Errors such as incorrect wiring, damaged components, or poor soldering can lead to circuit failure, which in turn affects the accuracy and success of the model. • Requires Technical Skills. Designers may lack the practical skills or confidence to assemble complex circuits correctly, especially if they are more comfortable with digital design tools.		

Q	Science	Maths	Electronic systems, programmable components and mechanical devices Question or outline of question / Marking scheme	AO	Total
			Limited Scalability. A physical model represents only one version of a circuit. Without simulation or duplication, it's challenging to test how it would perform under varied conditions or in higher production volumes. <i>Credit any other appropriate response.</i>		
				Total	25

Question 6: Paper boards

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The pictures below show some food packaging products. State the name of a suitable material for the pizza box. [1] <i>Answer:</i> corrugated cardboard. (Accept: cardboard). <i>Credit any other appropriate response.</i>	AO4 1a [1]	1
(ii)			The material used for the pizza box is made of three layers and a cross section of this material is shown below. State the name of the middle layer of the material shown in the picture below. [1] <i>Answer:</i> flutes/fluting. (Accept corrugation/corrugate). <i>Only acceptable response.</i>	AO4 1b [1]	1
(iii)			The pizza box is made using a die cutter. Describe one advantage of using a die cutter to cut the material. [2] Award 1 mark for identifying an advantage and an additional mark for providing a description. For example: Cutting corrugated cardboard on a die cutter will likely reduce damage to the flutes between the layers. <i>Answers provided may include:</i> 1. The cardboard edges will be neater than those cut by hand; 2. The cardboard development will have more accuracy; 3. Less chance of damaging the flutes in the middle of the two layers; 4. Die-cutting will speed up the production of the cardboard nets; 5. Die-cutting is ideal for rigid boards rather than flexible materials; 6. Die cutting removes human error. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
6. (a) (iv)			A model for the pizza box is made using a development or net. In the space below, use words and sketches to show how a development or net can be marked out and made using hand tools. [5] Award up to 5 marks for <i>both</i> words and sketches that demonstrate a clear understanding of the stages needed to make a development model for the pizza box using hand tools. Award a maximum of 3 marks if only accurate words or sketches are provided. <i>Answers provided may include:</i> 1. Accurate drawing of the development on card using ruler, protractor and sharp pencil. (1) Include cut lines as solid lines and folded lines as dotted lines (1) 2. Using a safety rule, craft knife and cutting mat, carefully cut the outline shape out of the development. (1) 3. Using a creasing tool, mark out the fold lines/ or lightly score the folded lines with a craft knife. (1) 4. Fold the box carefully using a safety ruler along the fold lines. (1) 5. Using double-sided tape/glue connect the box together using the flaps. (1) Credit should be given for quality control checks included within response. For example: using a creasing tool is much more accurate than using a craft knife which if too much pressure is used may cut through the corrugated cardboard. The use of a set square could be used whilst drawing the development and after cutting and creasing to ensure the development parts are at 90° to each other, where required. <i>Credit any other appropriate process that accurately shows how to make a development model for the pizza box.</i>	AO4 2c [5]	5

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
6. (b) (i)		5	The pizza box material costs the manufacturer £1.20 per metre. A pizza boxes requires 0.43 metres. Calculate the cost of the material to manufacture a batch of 750 pizza boxes. Show all workings. [2] 1 row of pizza boxes requires 0.43 metres at a cost of £1.20 per metre. $0.43 \text{ metres} \times £1.20 = £0.516$ (1) $750 \times £0.516 = £387$ (1)	AO4 1b [3] AO4 1c [2]	5
(ii)			The selling price of the pizza boxes to a retailer is 180% higher than the cost of the material. Calculate the selling price of one pizza box. [1] $£0.516/100 \times 180\% = £0.9288$ (1) accept £0.93		
(iii)			The pizza box is to be made using a thinner material that reduces the cost of the material by $\frac{1}{3}$. Calculate the new cost of one pizza box for the manufacturer to 2 decimal places. Show all workings. [2] $0.516/3 = 0.172$ (1) $£0.516 - £0.172 = £0.344$, accept £0.34 (or 34p) (1) <i>Do not penalise errors carried forward from 6. (b) (i)</i> <i>Credit any other appropriate approach to the calculations.</i>		

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total															
6. (c)			Analyse how the characteristics and properties of pulp make it suitable for moulding the egg box packaging. Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics of moulded pulp. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics of moulded pulp. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the characteristics of moulded pulp. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive, and candidates are not expected to refer to all the points identified below. <i>Moulded pulp</i> is made using water and recycled cellulosic paper and formed using moulds and wet pressing technology. Moulded Pulp Characteristics: Moulded pulp is a material that can easily be formed around 3D shapes and more complex products and as such provides a greater range of packaging solutions than flat sheet materials which tend to be restricted to simple geometric 3D shapes that can be made using developments.		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics of moulded pulp. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics of moulded pulp. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the characteristics of moulded pulp. There will be limited evidence of relevant examples or a logical chain of reasoning.	1		Award 0 marks for incorrect or irrelevant answers		AO3 2a [5]	5
	AO3 2a 5 marks																			
BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics of moulded pulp. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5																		
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	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
			• Moulded pulp provides excellent cushioning characteristics providing greater protection for products. • Moulded pulp is more difficult to print onto as the surface of the material tends to have texture rather than a smooth surface. • A range of thickness and types can be produced, including thick walled 5-10mm, transfer moulded 3-5mm and thermoformed 2-4mm. Thick-walled tends to be stronger and provides greater protection for the product. • It can be argued that moulded pulp products are more environmental as the structure of the pulp is predominantly made from water and recycled cellulosic materials. • Moulded pulp provides a greater strength-to-weight ratio, making the product lighter in weight. • It can be harder to print onto curved and moulded pulp packaging products than sheet materials with a flat surface. • Moulded pulp egg cartons are absorbent, should an egg break then it would absorb into the packaging and leak. <i>Credit any other appropriate response.</i>		

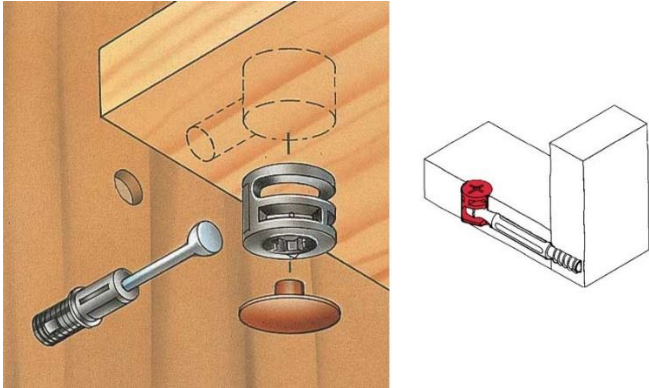
Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total															
6. (d)			Evaluate why a designer selected a foil-lined paper bag for warm food and duplex board for the cake box. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, a designer selected a foil-lined paper bag for warm food and a duplex board for the cake box. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, a designer selected a foil-lined paper bag for warm food and a duplex board for the cake box. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, a designer selected a foil-lined paper bag for warm food and a duplex board for the cake box. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td colspan="3">Award 0 marks for incorrect or irrelevant answers</td></tr></table>		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, a designer selected a foil-lined paper bag for warm food and a duplex board for the cake box. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, a designer selected a foil-lined paper bag for warm food and a duplex board for the cake box. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, a designer selected a foil-lined paper bag for warm food and a duplex board for the cake box. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
	AO3 2b 6 marks																			
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Award 0 marks for incorrect or irrelevant answers																				

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
			Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below. <i>Answers must evaluate foil-lined paper bags and duplex board to access the full 6 marks.</i> Advantages of Foil Lined Paper Bag: • Light in weight, therefore better for the consumer. • It has a good strength-to-weight ratio therefore is light in weight but strong and provides enough durability as a one-use product. • The foil lining provides heat insulation and will keep the food warm for longer. • The foil-lined board has oil and grease resistance preventing it from coming through to the paper backing, making it better for the consumer to hold. • The paper lining provides a surface to print onto, enabling consumer information or branding to be placed on the product. • The foil lining tends to add more rigidity to the packaging making it more stable, safe and durable. • Is easy to manufacture and cheap to manufacture. Note: Foil lined paper bags can be purchased to allow ease of separating materials. Although this is less common on a commercial scale, (see disadvantages below), credit should be awarded to candidates who discuss the advantages of being able to recycle both materials. Disadvantages of Foil Lined Paper Bag: • The thinness of the paper layer does not prevent all heat from transferring through to the consumer's hand, especially as the foil tends to be aluminium and therefore a good thermal conductor. • The foil lining is a non-renewable resource - not sustainable. • The foil will not biodegrade – poor environmental choice. • Whilst foil can be recycled, it also has a paper backing adding to the complexity of recycling. • Many consumers see packaging as a one-use disposable product, so the chances of waste ending up in landfills is high.		

Q	Science	Maths	Papers and boards Question or outline of question / Marking scheme	AO	Total
			Duplex Board is a two-layer board that consists a thin, moisture resistant paper layer and a thick, non-porous plastic layer. Advantages of Duplex Board: • Duplex board is rigid making it more stable, safe and durable and to protect the cakes from damage. • Light in weight therefore better for the consumer. • Duplex board is made of double-ply paper to increase rigidity and strength. • Duplex board has a smooth surface, ideal for printing consumer information or branding on the product. • Duplex board has a wax coating on the exterior, of the board, providing moisture resistance from any liquid spilt on the packaging and preventing air from getting inside the box. • Duplex board has a wax coating on the board's exterior, which prevents moisture from escaping from the cakes and keeping them fresher for longer. • The use of bleach in the pulping stage of manufacture will make the product brighter and whiter. Disadvantages of Duplex Board: • Duplex board for food packaging is not made from recycled paper for hygiene reasons, making them less sustainable. • The waxy coating on the board, makes it more difficult to recycle, especially as the plastic layer cannot be separated from the paper layer. • Many consumers see packaging as a one-use disposable product, so the chances of waste ending up in landfills is high. <i>Credit any other appropriate response.</i>		
				Total	25

Question 6: Natural and manufactured timbers

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The picture below shows a bookcase that is sold as a flat pack. State the name of a suitable softwood for the construction of the carcass of the bookcase. [1] <i>Answer:</i> Scots Pine, Parana Pine (Accept Pine). Accept: Western/Red Cedar <i>Credit any other appropriate response.</i>	AO4 1a [1]	1
(ii)			The joints of the bookcase are strengthened using standard components. State the name of the standard component shown. [1] <i>Answer:</i> Dowel <i>Only acceptable response.</i>	AO4 1b [1]	1
(iii)			The bookcase material was cut along the grain. Describe one advantage of cutting wood along the grain. [2] Award 1 mark for identifying an advantage and an additional mark for providing a description. <i>Answers provided may include:</i> 1. Larger strips of wood can be cut. 2. The finish of the wood is much better; cutting against the grain can leave bumps and knots visible. Or the finish of the wood is much better. 3. Improved strength / rigidity 4. Reduces number of potential pieces required. 5. Suits the shape of the bookcase in this example. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
6. (a) (iv)			The top and bottom of the bookcase are joined together using a cam lock knock-down fitting. Using notes and sketches, explain how a cam lock knock-down fitting would be used in the bookcase construction. [5] Award up to 5 marks for <i>both</i> words and sketches for demonstrating a clear understanding of the stages needed to create a knockdown fitting. Award a maximum of 3 marks if only accurate words or sketches are provided. <i>Answers provided may include:</i> 1. Drill hole / fit the cam lock nut 2. Drill hole / fit the CAM screw. 3. Align the two cam lock components, and slot together. 4. Place the cam lock nut in the cam hole. 5. Place the CAM screw into the cam lock nut and twist the cam to lock it. Credit should be given for quality control checks included within response. For example: Measure and mark out where the holes need to be drilled, check that the holes line up. Check the correct fittings are being used.  <i>Credit any other appropriate process that accurately shows how to install a KD fitting.</i>	AO4 2c [5]	5

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
6. (b) (i)		5	The bookcase material costs the manufacturer £12.50 per metre. Each bookcase requires 4.4 metres. Calculate the cost of the wood needed to manufacture a batch of 750 bookcases. Show all workings. [2] 1 bookcase requires 4.4 metres at a cost of £12.50 per metre. $4.4 \text{ metres} \times £12.50 = £55 \text{ (1)}$ $750 \text{ bookshelves} \times £55 = £41,250 \text{ (1)}$	AO4 1b [3] AO4 1c [2]	5
(ii)			The selling price of the bookcase is 360% higher than the cost of the material. Calculate the selling price of one bookcase. [1] $£55/100 \times 360\% = £198.00 \text{ (1)}$		
(iii)			The bookcase is to be scaled down, which reduces the cost of the materials by $\frac{1}{3}^{\text{rd}}$. Calculate the new material cost of one bookcase to 2 decimal places. Show all workings. [2] $£55/3 = £18.33 \text{ (1)}$ $£55 - £18.33 = £36.67 \text{ (1)}$ Do not penalise errors carried forward from 6. (b) (i) <i>Credit any other appropriate approach to the calculations.</i>		

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total															
6. (c)			Analyse the characteristics and properties of plywood and MDF (medium-density fibreboard) that make them suitable for flat-pack furniture manufacture. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics and properties of plywood and MDF that make the suitable for flat-pack furniture. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics and properties of plywood and MDF that make the suitable for flat-pack furniture. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the characteristics and properties of plywood and MDF that make the suitable for flat-pack furniture. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Answers must analyse the characteristics of at least two manufactured boards to access the full 5 marks.</i>		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics and properties of plywood and MDF that make the suitable for flat-pack furniture. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics and properties of plywood and MDF that make the suitable for flat-pack furniture. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the characteristics and properties of plywood and MDF that make the suitable for flat-pack furniture. There will be limited evidence of relevant examples or a logical chain of reasoning.	1		Award 0 marks for incorrect or irrelevant answers		AO3 2a [5]	5
	AO3 2a 5 marks																			
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	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
			Credit should be given to candidates who describe the difference between the structure of a plywood and MDF. <i>MDF is made from wood fibres of different sizes being compressed and joined together using a resin.</i> <i>Plywood is manufactured with thin layers of wood being glued together in odd numbers of layers that lie perpendicular to one another.</i> <i>Manufactured boards are suitable for the bookcase as they come in large sheets this means that larger items can be made, they are also cheaper and lighter than hardwood.</i> MDF Characteristics / Properties: • MDF is thicker, denser and heavier than softwood • MDF has no knots / grain and is therefore easier to machine and finish • MDF is made of fine particles, so no recognisable surface grain is visible – has a smooth face • MDF can be cut, drilled, machined and filed without damaging the surface • It is very stable and unaffected by humidity • MDF can be dowelled together, and traditional woodwork joints can be cut • MDF may be glued together with PVA wood glue • Veneers and laminates may also be used to finish MD • MDF has good stability when exposed to changes in temperature • MDF is available in a variety of thicknesses • MDF is reasonably cost effective • MDF is a sustainable material. Disadvantages • MDF will need additional production steps (veneering / staining) • MDF is heavier / more dense than natural timbers or alternatives like hardboard • Glues / chemicals / additional energy to produce – man made • Structurally not as rigid as natural boards		

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
			Plywood characteristics / Properties: • Available in sheets of a consistent quality • Large/standard size of boards means several parts can be 'nested' of one sheet and cut out • Excellent surface finish (to accept a spray paint finish or a laminate) • Consistent board thickness available • Free from natural defects, e.g. knots • Free from inconsistencies in physical characteristics, e.g. grain direction • Stability e.g. no warping or twisting like natural wood • Good strength to weight ratio. Disadvantages • Glues / chemicals / additional energy to produce – man made • Plywood will need additional production steps to manufacture the layered material • Edges can be subject to splintering / breakout • Bead / edge required to cover end layers – ugly. <i>Credit any other appropriate response.</i>		

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total															
6. (d)			Evaluate why the designer selected a softwood for the carcass and a manufactured board for the back of the bookcase. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer selected a softwood for the carcass and a manufactured board for the back. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer selected a softwood for the carcass and a manufactured board for the back. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer selected a softwood for the frame and a manufactured board for the back. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td colspan="3">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below. <i>Answers must evaluate both softwood and manufactured boards to access the full 6 marks.</i> Advantages of softwood: • Workability: Softwood is easier to work with and can be used across various applications • Sustainability: Softwood trees grow faster and are considered a very renewable source • Cost: These timbers tend to be cheaper, as they're easier to source • Readily available • Cheaper than hardwoods • Able to receive multiple finishes.		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer selected a softwood for the carcass and a manufactured board for the back. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer selected a softwood for the carcass and a manufactured board for the back. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer selected a softwood for the frame and a manufactured board for the back. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
	AO3 2b 6 marks																			
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Award 0 marks for incorrect or irrelevant answers																				

Q	Science	Maths	Natural and manufactured timber Question or outline of question / Marking scheme	AO	Total
			Disadvantages of softwood: • Density: The lower density of softwood timber means it's weaker and less durable • Fire resistance: Softwoods tend to have poor fire resistance unless treated • Can be knotty – unsightly • Less environmentally friendly unless FSC sourced. Advantages of manufactured board: • Available in larger sheets • Less likely to twist and warp out of shape • Cheaper to buy so products can be manufactured at a cheaper cost • Eco-friendlier as it uses less solid wood to make • Less absorbent when finish is added so can be sealed to add finishes • Available with smooth finishes with no grain which makes it easier to paint and achieve a good finish • Available with textured painted finishes. Disadvantages of manufactured boards: • Urea and phenol formaldehyde used for gluing can potentially cause disease • Plywood is in many aspects weaker than wood • Not durable like wood • Not always easy to sculpt on this • Lighter than normal wood • Without some special resistance method maximum after long-term get attacked by insects • Plywood cannot be exposed to wet or moist weather for a long period of time • The surface of plywood if not painted well can be peeled off. Note: Reference may be made to finishing treatments and appropriate credit should be given. <i>Credit any other appropriate response.</i>		
				Total	25

Question 6: Ferrous and non-ferrous metals

Q	Science	Maths	Ferrous and non-ferrous metals Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The picture below shows a gravel bicycle which can be used on or off-road. State the name of a suitable material for the metal frame. [1] <i>Answer: mild steel, accept mild steel tube, aluminium</i> <i>Credit any other appropriate response.</i>	AO4 1a [1]	1
(ii)			State the manufacturing process used to produce the crank arm shown in the picture below. [1] <i>Answer: Milling by hand or CNC accept Casting (or sand casting)</i> <i>Only acceptable response.</i>	AO4 1b [1]	1
(iii)			The sections of the gravel bicycle frame were cut with a radius on each end. Describe one advantage of cutting a radius on the end of each section of the bicycle frame. [2] Award 1 mark for identifying an advantage and an additional mark for providing a description. For example: Cutting the steel tubing with a radius provides more surface area for welding and better surface contact for the joint to be made. <i>Answers provided may include:</i> • If joints are cut straight, then there will be gaps and the joint will be weaker. • Allows the bike frame sections to be clamped so that they can be welded easily. • Makes the joint stronger as there is more surface area that is welded together. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Ferrous and non-ferrous metals Question or outline of question / Marking scheme	AO	Total
6. (a) (iv)			The hollow sections of the bicycle frame shown are joined together by welding. In the space below, use words and sketches to show how to weld a section of the bicycle frame. [5] Award up to 5 marks for <i>both</i> words and sketches that demonstrate a clear understanding of the stages needed to weld the bike frame together. Award a maximum of 3 marks if only accurate words or sketches are provided. <i>Answers provided may include:</i> 1. Positioning the parts of the frame together. Clamp parts to hold in position. (1) 2. Heating up the two sections to be joined together with a welding torch. (1) 3. Add flux and melt welding rod along the join of each section of the frame to create the joint. (1) 4. Leave to cool down. (1) 5. Include any health and safety factors such as wearing gloves and safety goggles when using the welding equipment to protect eyes and hands from heat and sparks. May include wearing a leather apron to protect clothing. (1) Credit should be given for quality control checks included within response. For example: clamping together or using a welding jig. <i>Credit any other appropriate process</i>	AO4 2c [5]	5

Q	Science	Maths	Ferrous and non-ferrous metals Question or outline of question / Marking scheme	AO	Total
6. (b) (i)		5	The hollow section used to manufacture the bicycle frame costs the manufacturer £12.50 per metre. Each gravel bicycle requires 6.2 metres. Calculate the cost of the metal needed to manufacture a batch of 750 gravel bicycle frames. Show all workings. [2] 1 bike frame requires 6.2 metres at a cost of £12.50 per metre. $6.2 \text{ metres} \times £12.50 = £77.50$ (1) $750 \text{ gravel bicycles} \times £77.50 = £58,125$ (1)	AO4 1b [3] AO4 1c [2]	5
(ii)			The selling price of the gravel bicycle is 360% higher than the cost of the material. Calculate the selling price of one gravel bicycle. [1] $£77.50/100 \times 360\% = £279.00$ (1)		
(iii)			The gravel bicycle frame is to be scaled down as a child's gravel bicycle, which reduces the cost of the material by $1/3^{\text{rd}}$. Calculate the new material cost of one child's gravel bicycle frame to 2 decimal places. Show all workings. [2] $£77.50/3 = £25.83$ (1) $£77.50 - £25.83 = £51.67$ (Accept £51.66) (1) <i>Credit any other appropriate approach to the calculations.</i>		

Q	Science	Maths	Ferrous and non-ferrous metals Question or outline of question / Marking scheme	AO	Total															
6. (c)			Analyse the characteristics and properties of appropriate metals that make them suitable for gravel bicycle frame manufacture. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics and properties of suitable metals. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics and properties of suitable metals. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the characteristics and properties of suitable metals. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Answers must analyse the characteristics of more than one suitable metal for the bike frame to access the full 5 marks.</i> Note: Credit should be given to candidates who describe the difference between ferrous and non-ferrous metals such as mild steel which is a ferrous metal and contains iron, which will rust, and aluminium which is non-ferrous metal containing no iron, which does not rust.		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics and properties of suitable metals. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics and properties of suitable metals. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the characteristics and properties of suitable metals. There will be limited evidence of relevant examples or a logical chain of reasoning.	1		Award 0 marks for incorrect or irrelevant answers		AO3 2a [5]	5
	AO3 2a 5 marks																			
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BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the characteristics and properties of suitable metals. There will be limited evidence of relevant examples or a logical chain of reasoning.	1																		
	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Ferrous and non-ferrous metals Question or outline of question / Marking scheme	AO	Total
			Advantages: • Mild steel is strong, can with stand impact when in use. • Mild steel can be welded together allowing bike frames to be manufactured. • Mild steel is available in lots of different sections • Mild steel can be finished with paints to protect it from the weather/elements. • Available locally as a source of material. • Can be recycled and reused making it a sustainable material. Disadvantages: • Mild steel is a ferrous metal, which contains iron and therefore will rust. • Mild steel is heavy – tiring for the rider. • Less distance able to be cycled. • Can corrode / rust – especially if paint finish is damaged. Advantages: • Aluminium is strong, impact resistant when in use. • Aluminium can be joined together using TIG or MIG welding. • Aluminium can be cast into different shapes for bike parts such as pedals, brake parts. • Aluminium is available in lots of different sections making it suitable for bike frames. • Aluminium is not magnetic and it does not contain iron and therefore does not rust. • Aluminium is lightweight making it suitable for racing bike frames. • Can be recycled and reused making the material sustainable. • Can be coloured or anodised to create different finishes. Disadvantages: • Difficult to achieve aesthetic quality finish with aluminium welding. • Aluminium is more expensive than steel – price of purchase goes up. • Production costs will increase. • Less dense / durable than steel. <i>Credit any other appropriate response.</i>		

Q	Science	Maths	Ferrous and non-ferrous metals Question or outline of question / Marking scheme	AO	Total															
6. (d)			Evaluate the reasons the designer uses CAD software to model bicycle frames compared to physically making bicycle frames. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer uses CAD software to model the bicycle frame compared to physically making the bicycle frames. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer uses CAD software to model the bicycle frame compared to physically making the bicycle frames. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer uses CAD software to model the bicycle frame compared to physically making the bicycle frames. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below. Examples of CAD software may be given in response to this question.		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer uses CAD software to model the bicycle frame compared to physically making the bicycle frames. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer uses CAD software to model the bicycle frame compared to physically making the bicycle frames. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer uses CAD software to model the bicycle frame compared to physically making the bicycle frames. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2		Award 0 marks for incorrect or irrelevant answers			6
	AO3 2b 6 marks																			
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	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Ferrous and non-ferrous metals Question or outline of question / Marking scheme	AO	Total
			Advantages of using CAD software to model the bicycle: • The bicycle frame can be tested before production. • Strength tests carried out on the frame to identify any stress points to the frame. • CAD modelling is quicker than physically making the bicycle frame. • CAD modelling the bicycle frame is cheaper as the frame is modelled on screen. • Different materials can be tested and simulations made to test out the suitability of the bicycle frame. • The CAD file can be used to manufacture the bicycle frame using CAM machinery. • The CAD file can be sent via email to different locations. • The CAD model can be rendered in different finishes to show what the bicycle would look like when produced. • The CAD model can be linked to other parts of the bicycle to check tolerances and different functions of the bicycle. • Changes can be easily made to the bicycle frame design prior to production. • Dimension drawings of parts and assembly drawings can be generated to assist with production and manufacture. Disadvantages of using CAD software to model the bicycle: • CAD modelling software maybe expensive. • CAD Modelling software will require a highly skilled person to use it. • Hardware to run the software maybe expensive. • The CAD model cannot be physically tested in real life. <i>Credit any other appropriate response.</i>		
				Total	25

Question 6: Thermoforming and thermosetting plastics

Q	Science	Maths	Thermoforming and thermosetting plastics Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The pictures below shows two sets of bowls. State the name of a specific polymer used to make the thermosetting bowl set. <i>Answer: Melamine (Accept Melamine Formaldehyde)</i> <i>Credit any other appropriate response.</i>	AO4 1a [1]	1
(ii)			State the name of the polymer molecular structure shown in the picture below [1] <i>Answer: Thermoforming Polymer. Accept: Thermo polymer</i>	AO4 1b [1]	1
(iii)			A prototype for the bowl was made using a vacuum former and was trimmed out using a gerbil. [2] Describe one advantage of using a gerbil rather than other techniques. Award 1 mark for identifying an advantage and an additional mark for providing a description. For example: Using a gerbil is more accurate than using other methods such as a bandsaw or cutting knife. Answers provided may include: • Using a gerbil is more controllable than other methods • Using a gerbil is considered safer than other methods • Trimming curves is easier than other methods <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Thermoforming and thermosetting plastics Question or outline of question / Marking scheme	AO	Total
6. (a) (iv)			In the space below, use words and sketches to show how a prototype bowl is vacuum formed. [5] Award up to 5 marks for <i>both</i> words and sketches that demonstrate a clear understanding of the stages needed to vacuum form a prototype bowl. Award a maximum of 3 marks if only accurate words or sketches are provided. <i>Answers provided may include:</i> • The mould is made using MDF, expanded polystyrene or other suitable material. (1) • The mould is placed into the vacuum former. (1) • A sheet of material [HIPS, for example] is placed above the mould and clamped down. (1) • The electric element [heater] is turned on and begins to warm and soften the sheet material. (1) • When the sheet material is flexible, the mould is moved up to the plastic using the handle. (1) • The pump is turned on, and the air is removed from under the plastic, sucking the plastic over the mould. (1) • The mould is removed and cut/trimmed using a gerbil. [1] Credit should be given for an understanding of the mould requirements included within response. For example: sloped sides to enable the mould to be removed, curved edges to prevent stretching, air holes to pull the plastic into internal parts of the mould. <i>Credit any other appropriate process that accurately shows how to vacuum form a prototype for the bowl.</i>	AO4 2c [5]	5

Q	Science	Maths	Thermoforming and thermosetting plastics Question or outline of question / Marking scheme	AO	Total
6. (b) (i)		5	The granules of polymer for injection moulding cost £1.80 per kilogram. Each bowl requires 0.10 kilograms to mould. Calculate the cost of the granules to manufacture a batch of 750 bowls. Show all workings. [2] 1 bowl requires 0.10 kilogram at a cost of £1.80 per kilogram. $0.1 \text{ kg} \times £1.80 = £0.18$ (1) $750 \text{ bowls} \times £0.18 = £135$ (1)	AO4 1b [3] AO4 1c [2]	5
(ii)			The selling price of the bowl is 420% higher than the cost of the polymer granules. Calculate the selling price of one bowl. [1] $£0.18/100 \times 420\% = £0.756$ (1) allow £0.76 or 76p <i>Allow for carry forward of incorrect answer to 6 (b)(i)</i>		
(iii)			The bowl is to be made using a different polymer, which reduces the cost of the granules by $\frac{1}{3}$rd. Calculate the new cost of the granules required for one bowl to 2 decimal places. Show all workings. [2] $0.18/3 = £0.06$ (1) $£0.18 - £0.06 = £0.12$ (1) accept 12p <i>Allow for carry forward of incorrect answer to 6 (b)(i)</i> <i>Credit any other appropriate approach to the calculations.</i>		

Q	Science	Maths	Thermoforming and thermosetting plastics Question or outline of question / Marking scheme	AO	Total															
6. (c)			Analyse the characteristics and properties of thermosetting and thermoforming polymers that make them suitable for moulding the bowls. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics thermosetting and thermoforming polymers that make them suitable for moulding the bowls. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics thermosetting and thermoforming polymers that make them suitable for moulding the bowls. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the characteristics of thermosetting and thermoforming polymers that make them suitable for moulding the bowls. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive and candidates are not expected to refer to all the points identified below. <i>Answers must analyse the characteristics of both thermoforming and thermosetting polymers to access the full 5 marks.</i>		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics thermosetting and thermoforming polymers that make them suitable for moulding the bowls. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics thermosetting and thermoforming polymers that make them suitable for moulding the bowls. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the characteristics of thermosetting and thermoforming polymers that make them suitable for moulding the bowls. There will be limited evidence of relevant examples or a logical chain of reasoning.	1		Award 0 marks for incorrect or irrelevant answers		AO3 2a [5]	5
	AO3 2a 5 marks																			
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BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics thermosetting and thermoforming polymers that make them suitable for moulding the bowls. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3																		
BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the characteristics of thermosetting and thermoforming polymers that make them suitable for moulding the bowls. There will be limited evidence of relevant examples or a logical chain of reasoning.	1																		
	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Thermoforming and thermosetting plastics Question or outline of question / Marking scheme	AO	Total
			Credit should be given to candidates who describe the difference between thermosetting and thermoforming polymers: <i>Thermosetting Polymer</i> stock forms for moulding are generally a compound, the polymer is cured. due to the cross-linked molecular structure, thermosetting polymers can only be heated and moulded once. <i>Thermoforming Polymer</i> stock forms for injection moulding are generally pellets/granules, these are heated and moulded. Thermoforming polymers can be heated and remoulded a number of times hence better for closed loop systems and recycling purposes. Thermosetting Polymers: • Thermosetting polymers can have special-purpose additives applied to improve the structure and properties of the polymer. • Stabilisers – heat stabilisers are added to preserve the polymer's appearance, strength and durability. • Pigments – to add colour to the polymer. • Cure regulators – to ensure the chemical reaction works more effectively during the curing process. • Lubricants – to ensure that the polymer, once injected into the mould, comes out easier. • Thermosetting polymers tend to have higher melting points and heat resistance which requires more energy and heat during the injection moulding process. Thermoforming Polymers: • Thermoforming polymers can have special purpose additives applied to improve the structure and properties of the polymer. • Stabilisers – heat stabilisers are added to preserve the polymers appearance, strength, durability. • Pigments – to add colour to the polymer. • Lubricants – to ensure that the polymer once injected into the mould, comes out easier. • Thermoforming polymers are generally soft and pliable therefore suiting themselves ideally for moulding purposes. • Thermoforming polymers tend to have lower melting points, ensuring that less energy and heat are required when converting the pellets/granules from solid to liquid for moulding. <i>Credit any other appropriate response.</i>		

Q	Science	Maths	Thermoforming and thermosetting plastics Question or outline of question / Marking scheme	AO	Total															
6. (d)			Evaluate why the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive, and candidates are not expected to refer to all the material identified below. <i>Answers must evaluate both thermosetting and thermoforming polymers to access the full 6 marks.</i>		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2		Award 0 marks for incorrect or irrelevant answers		AO3 2b [6]	6
	AO3 2b 6 marks																			
BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6																		
BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4																		
BAND 1	Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer selected a thermosetting polymer for one type of bowl and a thermoforming polymer for the other type of bowl. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2																		
	Award 0 marks for incorrect or irrelevant answers																			

Q	Science	Maths	Thermoforming and thermosetting plastics Question or outline of question / Marking scheme	AO	Total
			Advantages Thermosetting Polymers: • Light in weight/good strength to weight ratio, makes it more comfortable to carry with contents. • Thermosetting polymers are more durable than most thermoforming polymers resulting in a longer life for the product. • Thermosetting polymers have more hardness than thermoforming polymers making them better at abrasion/scratching resistance, extending the bowl's life. • Thermosetting resins such as melamine formaldehyde are generally considered food-safe. • Thermosetting polymers such as melamine formaldehyde are considered 'shatterproof', therefore adding protection to the product if dropped on a hard kitchen floor. • Thermosetting polymers are dishwasher safe. • Thermosetting polymers can withstand microwaves and therefore are useful for heating food. Disadvantages of Thermosetting Polymers: • Thermosetting polymers tend to be more expensive than thermoforming polymers. • There is more of a limited choice of thermosetting polymers for the manufacturer. • Does not biodegrade – poor environmental choice. • Thermosetting polymers are oil [carbon-based] materials which are a non-renewable resource. • It can be argued that thermoforming polymers are less environmental as the characteristics mean they are unable to be recycled, although they tend to be more durable than thermoforming polymers and therefore will last longer as a product. • Recent research has shown that when melamine formaldehyde is heated to above 70°, the chemical bonds may mean that melamine monomers are released. Advantages of Thermoforming Polymers: • Thermoforming Polymers have a greater range of materials that can be used to make a bowl, e.g. HDPE, LDPE, PP. This in turn gives the manufacturer more choice of materials and properties. • It can be argued that thermoforming polymers are better for the environment as the characteristics mean they can be recycled.		

Q	Science	Maths	Thermoforming and thermosetting plastics Question or outline of question / Marking scheme	AO	Total
			Disadvantages of Thermoforming Polymers: - Thermoforming polymers are less able to withstand microwave use, making them less practical for heating food due to their lower melting points. - Thermoforming polymers are cheaper, reducing costs for the manufacturer and making more affordable products for the consumer. - Thermosetting polymers are oil [carbon based] materials which are a non-renewable resource. - Recycling identification marks can be put onto the products, although consumer habits may mean that they are disposed of incorrectly or in the landfill. Thermoforming polymers are prone to cross-material contamination if not separated correctly during recycling. This can affect the quality of the raw material for injection moulding. Amorphous and Semi-Crystalline Thermoforming Polymers: - Amorphous thermoforming polymers are transparent. - Semi-Crystalline thermoforming polymers are opaque. The more semi-crystalline the polymer, the higher density, stiffness, higher the melting point, but the reduced impact resistance. Note: Reference can be made to the use of additives to improve the properties of both thermoforming and thermosetting polymers. Reference may be made to finishing treatments and appropriate credit should be given. The use of UV inks is commonly used as the ink is dry as soon as the printing is finished. <i>Credit any other appropriate response.</i>		
				Total	25

Question 6: Fibres and textiles

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The picture below shows a winter dress made from a polyester pile fabric. State the name of a pile fabric suitable for the dress. [1] <i>Answer:</i> velvet, velveteen or velour. (Accept: chenille, corduroy, plush). <i>Do not accept:</i> terry towelling. <i>Credit any other appropriate response.</i>	AO4 1a [1]	1
(ii)			The dress sleeve cuffs are made from a woven fabric. State the name of the woven construction shown in the picture below. [1] <i>Answer:</i> plain weave <i>Only acceptable response.</i>	AO4 1b [1]	1
(iii)			The dress fabric was cut on the bias. Describe one advantage of cutting fabric on the bias. [2] Award 1 mark for identifying an advantage and an additional mark for providing a description. For example: Cutting fabric on the bias gives a greater stretch than when cut on the straight of grain. <i>Answers provided may include:</i> 1. Fabric will appear finer / 'thinner' (and 'softer'); 2. Fabric drapes softly over the body/contours to the shape of the body; 3. Reduced fraying of cut fabric edges; 4. Fabric has more fluidity and movement; 5. Provides a slim silhouette when made into a garment. <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
6. (a) (iv)			The front and back of the dress are joined together with top-stitched plain seams. In the space below, use words and sketches to show how a top-stitched plain seam is manufactured. [5] Award up to 5 marks for <i>both</i> words and sketches that demonstrate a clear understanding of the stages needed to sew a top stitched plain seam. Award a maximum of 3 marks if only accurate words or sketches are provided. <i>Answers provided may include:</i> 1. Place/pin rights sides of fabric together. (1) 2. Machine sew (a straight/running stitch) using a 1.5cm seam allowance. (1) 3. Reverse stitch to secure seam. (1) 4. Press seams closed/open. (1) 5. Overlock or edge finish seam. (1) 6. Top stitch 2-3mm from seam. (1) Credit should be given for quality control checks included within response. For example: tack fabric together prior to sewing to prevent fabric movement when stitching; extend stitch length to accommodate pile fabric thickness; cut loose threads. <i>Credit any other appropriate process that accurately shows how to produce a top stitched plain seam.</i>	AO4 2c [5]	5

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
6. (b) (i)		5	The dress fabric costs the manufacturer £12.50 per metre. Each dress requires 2.2 metres. Calculate the cost of the fabric to manufacture a batch of 750 dresses. Show all workings. [2] 1 dress requires 2.2 metres at a cost of £12.50 per metre. $2.2 \text{ metres} \times £12.50 = £27.50$ (1) $750 \text{ dresses} \times £27.50 = £20,625$ (1)	AO4 1b [3] AO4 1c [2]	5
(ii)			The selling price of the dress is 360% higher than the cost of the fabric. Calculate the selling price of one dress. [1] $£27.50/100 \times 360\% = £99.00$ (1)		
(iii)			The dress is to be manufactured in an alternative summer-weight linen fabric, that reduces the cost of the fabric by a $\frac{1}{3}$rd. Calculate the new material cost of one dress to 2 decimal places. Show all workings. [2] $£27.50/6 = £4.58 \times 2 = £9.17$ or $\frac{1}{3} \times (£27.50) = £9.17$ (1) $£27.50 - £9.17 = £18.33$ (1) <i>Do not penalise errors carried forward from 6b(i)</i> <i>Credit any other appropriate approach to the calculations.</i>		

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total															
6. (c)			Analyse the characteristics of woven and knitted fabrics that make them suitable for garment manufacture. [5] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2a 5 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics of woven and knitted fabrics. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td><td>4-5</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics of woven and knitted fabrics. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td><td>2-3</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, to analyse the characteristics of woven and knitted fabrics. There will be limited evidence of relevant examples or a logical chain of reasoning.</td><td>1</td></tr><tr><td></td><td colspan="2">Award 0 marks for incorrect or irrelevant answers</td></tr></table> Indicative content This content is not prescriptive, and candidates are not expected to refer to all the points identified below. Answers must analyse the characteristics of both woven and knitted fabrics to access the full 5 marks. Credit should be given to candidates who describe the difference between the structure of a woven and knitted fabric:		AO3 2a 5 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the characteristics of woven and knitted fabrics. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the characteristics of woven and knitted fabrics. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the characteristics of woven and knitted fabrics. There will be limited evidence of relevant examples or a logical chain of reasoning.	1		Award 0 marks for incorrect or irrelevant answers		AO3 2a [5]	5
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BAND 1	Answer demonstrates only basic knowledge and understanding, to analyse the characteristics of woven and knitted fabrics. There will be limited evidence of relevant examples or a logical chain of reasoning.	1																		
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Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
			<i>Woven fabrics</i> are produced using warp and weft yarns. The yarns are interlaced at right angles to each other. They are created on a loom. <i>Knitted fabrics</i> are produced through interlocking loops of yarn. They can be produced by hand using a continuous, single yarn (weft knit), or by machine using multiple yarns (warp knit). Woven Fabric Characteristics: • Woven fabrics do not stretch (except on the bias or with the addition of an elastic fibre, such as elastane/Lycra®) requiring the fabric to be constructed and sewn to fit the body. As a consequence, woven fabric garments use more pattern pieces and are therefore more expensive to manufacture. • Woven fabrics are less flexible than knitted fabrics due to the compactness of the woven structure. • Woven fabrics are generally more durable than knitted fabrics as the warp and weft yarns interlink producing a compact structure. • Woven fabrics do fray which means seams need to be finished in some way. • Woven fabrics can withstand many washes without deforming or changing appearance. • Woven fabrics do not pill – produce bobbles - (like knitted fabrics) as the yarns/filaments are tightly spun. • Woven fabrics are breathable due to the gaps formed when the warp and weft yarns interlink but are far less breathable than knitted fabrics which are more open in structure. • Woven fabrics can be deemed less comfortable to wear in comparison to knitted fabrics as they need to be constructed/sewn to fit the body and can feel more restricted upon wearing. • Woven fabrics – unless they include an elastane – crease. • It can be argued that woven fabrics are more environmental as the characteristics mean they are durable and long lasting, don't deform and can be washed – generally – easily. Knitted Fabric Characteristics: • Knitted fabrics have a high stretch capability making them more form fitting. This is due to the open yarn structure. They can therefore fit a range of body shapes and sizes. • Knitted fabrics can easily stretch out of shape, distorting garment appearance and fit.		

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
			- Knitted fabrics pill – bobble – easily due to the loosely spun yarns. This weakens the garments strength and durability and affects the appearance. - Knitted fabrics do not fray easily (the loop structure of weft knit fabrics can unravel) so do not necessarily need to be finished. Woven fabrics do fray and need finishing in garment construction. - Knitted fabrics are typically highly breathable, more so than woven fabrics, due to the knitted fabrics open, looped structure. - Knitted fabrics are warm to wear – they are good insulators - as the open loop structure traps air. - Loose yarn/fibres make knit fabric soft and comfortable to wear next to the skin. (However, some consumers may find the loose fibres an irritant). - Knitted fabrics are crease resistant even when the yarns are made from natural fibres, (such as cotton that does crease), due to the stretching ability of the looped structure. - Knitted fabrics – generally – are difficult to care for without the addition of elastane fibres. They can shrink and deform on washing. They often need to be dried flat which is inconvenient to the consumer and can take a long time to dry. - Knitted garments use less pattern pieces as they stretch to fit the body which means they are cheaper to manufacture/purchase. - It can be argued that knitted fabrics are less environmental as the characteristics mean they are less durable, appearance is affected due to pilling, and they can distort on wearing/washing. Consumers may discard soon after purchase. <i>Credit any other appropriate response.</i>		

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total															
6. (d)			Evaluate why the designer selected a polyester pile fabric for the winter dress and a linen fabric for the summer dress. [6] Band descriptors and mark allocations <table><tr><td></td><td colspan="2">AO3 2b 6 marks</td></tr><tr><td>BAND 3</td><td>A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer selected a polyester pile fabric for the winter dress and a linen fabric for the summer dress. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td><td>5-6</td></tr><tr><td>BAND 2</td><td>Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer selected a polyester pile fabric for the winter dress and a linen fabric for the summer dress. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.</td><td>3-4</td></tr><tr><td>BAND 1</td><td>Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer selected a polyester pile fabric for the winter dress and a linen fabric for the summer dress. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td><td>1-2</td></tr><tr><td colspan="3">Award 0 marks for incorrect or irrelevant answers</td></tr></table>		AO3 2b 6 marks		BAND 3	A coherent answer demonstrating detailed, relevant knowledge and understanding, when evaluating the reasons, the designer selected a polyester pile fabric for the winter dress and a linen fabric for the summer dress. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	5-6	BAND 2	Answer has some coherence, demonstrating partial knowledge and understanding, when evaluating the reasons, the designer selected a polyester pile fabric for the winter dress and a linen fabric for the summer dress. There will be some evidence of mostly relevant examples and partly-substantiated judgements in a response which is generally well structured.	3-4	BAND 1	Answer demonstrates only basic knowledge and understanding, when evaluating the reasons, the designer selected a polyester pile fabric for the winter dress and a linen fabric for the summer dress. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	1-2	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
	AO3 2b 6 marks																			
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Award 0 marks for incorrect or irrelevant answers																				

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
			Indicative content This content is not prescriptive and candidates are not expected to refer to all the material identified below. <i>Answers must evaluate both polyester pile fabric and linen fabric to access the full 5 marks.</i> Advantages of Polyester Fabric: • Light in weight therefore comfortable to wear. • Has good tensile strength therefore can have a long life. • Is durable and abrasion resistant extending the life of the garment. • Has good elasticity therefore is crease resistant and easy to care for. • Is stain resistant (as has low absorbency) which helps appearance and ease of care. • Quick to dry (as has low absorbency) and this helps ease of care. • Has good chemical resistance and is not destroyed by insects. • Easy to wash and at low temperatures. • Good colourfastness and does not fade easily in sunlight. • Has a lustrous (shine) giving garments a quality appearance. • Tensile strength does not differ when wet or dry. • Is flame resistant – although does melt easily (thermoforming). • Is easy to manufacture and is cheap to manufacture, using limits amount of water and energy in production. Disadvantages of Polyester Fabric: • Has poor absorbency making the fabric difficult to dye. • Melts easily which makes pressing/ironing more difficult. • Poor absorbency means a static build-up occurs attracting/contaminating fabric with dust (particularly noticeable on pile fabrics and those that are black in colour). • Is made from non-renewable/fossil fuels – not sustainable. • Does not biodegrade – poor environmental choice.		

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
			Pile Fabrics: • The pile traps air helping the fabric become a good insulator (even though polyester is not a good insulator). • Increases the resilience/durability of the material due to the thickness of the fabric (extra yarn). • Has a softer 'handle' making the fabric more comfortable next to skin. • The designer can easily identify the right side of the fabric (RS) and the wrong side of the fabric (WS). • The polyester pile attracts dust due to positive static charge (poor absorbency), spoiling appearance of the fabric. • Has a nap – shading of colour occurs when pattern pieces are sewn in different directions – which affects the aesthetic appearance negatively. Advantages of Linen Fabric: • Linen is very absorbent (moisture wicking), which makes the fabric comfortable next to the skin as it allows the skin to breath. • Linen is breathable which means it is cool to wear and this is why it is a popular fabric for summer garments. • Has a natural, aesthetic appearance making it an attractive, quality choice for garments. • Has a very good tensile strength and durability ensuring it has a long life. • It is flammable and burns to an ash but has a high resilience to temperature so can be pressed/ironed easily. • Linen is easily washed (it is absorbent) and can withstand very high temperatures up to 100°C which is good for removing contaminants and can be ironed/pressed. It softens on boiling but it will crease really badly. • Easily dyed a range of colours due to exceptional absorbency. • It is anti-static (as absorbent) making it comfortable to wear. • Is insect repellent extending life of garments made from linen. • Is biodegradable and more environmentally sound than polyester. • Linen is a hypoallergenic material.		

Q	Science	Maths	Fibres and textiles Question or outline of question / Marking scheme	AO	Total
			Disadvantages of Linen Fabric: • Has poor elasticity which means linen creases really badly. However, it is easy to iron at high temperatures. • An expensive material due to growth and numerous production processes and this can be deemed as not beneficial environmentally. • Linen can be bleached and this affects its biodegradable abilities. • Can shrink if washed at high temperatures on a first wash. Note: Linen is the fabric that derives from the flax plant. Candidates may reference in their response and must not be discredited. Reference may be made to finishing treatments and appropriate credit should be given. Both polyester and linen can withstand mechanical (brushing, calendering) and chemical finishes such as mercerising, crease resistant (linen only), anti-static (polyester only). Candidates may discuss cutting pile fabric on the bias which makes any garment more expensive due to the extra wastage of fabric that occurs. However, cutting fabric on the bias brings advantages to handle, drape and fluidity and credit should be awarded. <i>Credit any other appropriate response.</i>		
				Total	25