



Oxford Cambridge and RSA

GCSE

Design and Technology

J310/01: Principles of design and technology

General Certificate of Secondary Education

Mark Scheme for June 2022

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *assessor3 Online Training; OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to assessor3 and mark the **required number** of practice responses (“scripts”) and the **number of required** standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the assessor3 messaging system, or by email.
5. **Crossed Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Multiple Choice Question Responses

When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.
7. Award No Response (NR) if:
 - there is nothing written in the answer space

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The assessor3 **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the assessor3 messaging system, or e-mail.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.
10. For answers marked by levels of response:
- To determine the level** – start at the highest level and work down until you reach the level that matches the answer
 - To determine the mark within the level**, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. Annotations

Annotation	Meaning
BP	Blank page
✓	Point where mark is awarded
L1	Level one response
L2	Level two response
L3	Level three response
ECF	Error carried forward
REP	Repetition
SEEN	Noted, but no credit given
PD	Poor diagram offering unclear response
TV	Too vague

12. Subject Specific Marking Instructions

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

LEVELS OF RESPONSE QUESTIONS (also refer to point 10 above):

The indicative content indicates the expected parameters for candidates' answers but be prepared to recognise and credit unexpected approaches where they show relevance.

Using 'best-fit', decide first which set of level descriptors best describes the overall quality of the answer. Once the level is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement.

Highest mark: If clear evidence of all the qualities in the level descriptors is shown, the HIGHEST mark should be awarded.

Lowest mark: If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the levels below and show limited evidence of meeting the criteria of the level in question) the LOWEST mark should be awarded.

Middle mark: This mark should be used for candidates who are secure in the level. They are not 'borderline' but they have only achieved some of the qualities in the level descriptors.

Be prepared to use the full range of marks. Do not reserve (e.g.) highest level marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the level descriptors, reward appropriately.

Assessment Objectives

AO3: Analyse and evaluate –

- design decisions and outcomes, including for prototypes made by themselves and others
- wider issues in design and technology

AO4 Demonstrate and apply knowledge and understanding of –

- technical principles
- design and making principles

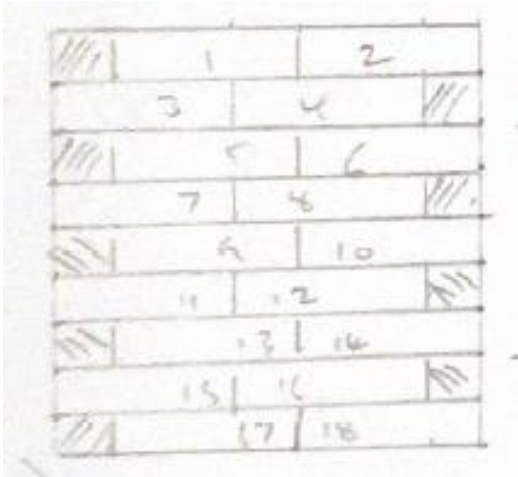
Question	AO3	AO4	Question	AO3	AO4
1a		3	4a		2
1b		1	4b		2
1c		2	4c		2
1d	2	2	4d	3	
1e	2		5a		12
1f	4		5b		4
1g*	5	3	5c		2
2a		4	5d		6
2b		4	6a		4
2c		1	6b*	2	6
2d		4			
2e		4			
3a		5			
3b		2			
3c		2			
3d		3			
3e	2				

Question			Answer	Mark	Guidance
1	(a)	(i)	For one mark: (An alloy is) a mix of TWO or more elements. (ONE of which is a metal.	1	Mix of metals Mix of metal and other element
1	(a)	(ii)	One mark each reason. Two required. E.g.: <ul style="list-style-type: none"> • good strength to weight ratio • corrosion resistant so the scooter will withstand weather conditions • Alloy is available in tubular sections and sheet stock forms used in scooter • Alloys can provide specific properties so materials can be selected to provide best material for the scooter • Lightweight Award credit for any other appropriate response.	2	Reasons must be appropriate for the context in the question: scooter frame and deck Do not accept generic terms eg. Strong, durable, cheap, light without qualification/explanation. eg. Strong = 0 marks, strong so can support weight of the user = 1 mark
1	(b)		One mark from e.g.: <ul style="list-style-type: none"> • It is soft so comfortable to hold/ good ergonomics • It will provide grip • It can be moulded to shape • Resistant to wear and tear from use / damage • Water resistant / waterproof Award credit for any other appropriate response.	1	Reason must be appropriate for the context in the question: handlebars covered in thermo polymer Do not accept generic terms eg. Strong, durable, cheap, light without qualification/explanation. eg. durable = 0 marks, durable so will not tear easily = 1 mark
1	(c)		One mark for each identification. Two required. E.g.: <ul style="list-style-type: none"> • Local council / government • Police • Other Road users/ car owners • Pedestrians • Shop owners / retailers • Manufacturer of the scooter Award credit for any other appropriate response.	2	Do not award credit for primary user the question asks for wider stakeholders. Answers must be appropriate for the context in the questions: wider stakeholders to be considered for the scooter.

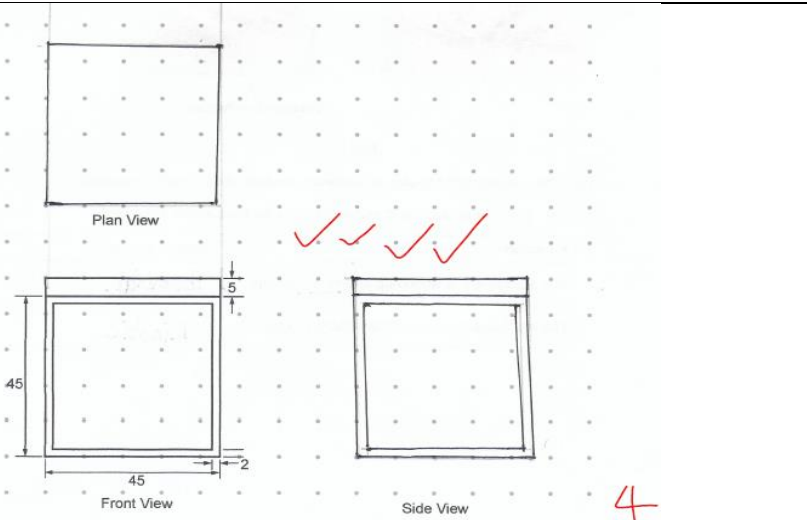
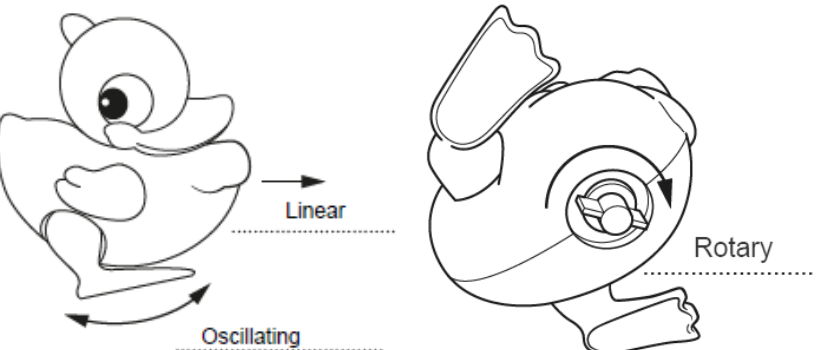
Question		Answer	Mark	Guidance
1	(d)	<p>Up to two marks for each identification. Two required. E.g.:</p> <ul style="list-style-type: none"> • The width of a foot (1) for the platform length/width(1) • Hand grip (1) for handlebar diameter (1) • Hand width (1) for handle TPE grip length (1) • Height of a person (1) to determine height of handlebars (1) • Weight of person (1) to determine structural strength of deck or wheels (1) <p>Award credit for any other appropriate response.</p>	4	<p>One mark for a suitable identified human measurement and One mark for linking that to the scooter design.</p> <p>Must provide a human size that is related to part of the scooter</p>
1	(e)	<p>One mark for each feature explained. Two required. E.g.:</p> <ul style="list-style-type: none"> • Adjustable handles to suit different size users • Textured surface on platform to stop users from slipping • The mud guards will stop splashes from the wheels keep clothes clean • The size (length or width) of the platform is suitable for user of different ages • The handle grips make it comfortable to steer • Because it's electric it can help people travel around more easily as it provides assisted power <p>Award credit for other appropriate responses.</p>	2	<p>Features must be related to the context in the question: electric scooter</p> <p>The explanation mark is about how it improves usability.</p> <p>Do not award marks for just re stating what is labelled in Fig.1 e.g.:</p> <ul style="list-style-type: none"> • Height adjustable handlebars • Pull out stand • Textured surface

Question		Answer	Mark	Guidance
1	(f)	<p>Up to two marks for each explanation. Two required. E.g.:</p> <ul style="list-style-type: none"> • It could reduce traffic and car use for short journeys (1) reduces cost of travel for users as its cheaper than petrol in cars (1) • It could be dangerous to pedestrians/users (1) if used on paths and pavements/ when on roads with cars and traffic (1) • It could improve health and well-being of users (1) as they will be outside more (1) • Increase in theft or vandalism (1) as scooters are left outside when not in use (1) • The use of an app to hire (1) may exclude people without smart phones from hiring (1) • Charge may not be sufficient (1) meaning journeys can't be completed fully (1) <p>Award credit for other appropriate responses.</p>	4	<p>Responses must relate to the social and cultural impacts rather than sustainable issues</p> <p>Max 1 mark for reference made to being environmentally friendly unless it relates to social aspects</p> <p>Can be negative or positive impacts</p>

Question		Answer	Mark	Guidance	
				Content	Levels of response
1	(g)*	<p>Discussion could include:</p> <ul style="list-style-type: none"> environmental impacts associated with charging the e-scooter during its life are small sourcing of materials such as aluminium alloy, TPE for handlebars, polymer for tyres, lithium batteries or electrical components like motors and wiring, the charging unit – this could be generic - core level knowledge of LCA but acknowledgement the scooter uses a range of materials that will all need to be sourced and their sourcing and processing and manufacture will use energy and create pollution manufacturing and assembly of the scooter, welding, riveting, powder coating/painting of decals/ assembly of components etc this could be generic - core level knowledge of LCA Transportation from factory to site and ongoing movement by local council to ensure availability and also to maintain/repair of broken/vandalised. Disposal at end of life – disassembly and recycling and how range of material and finish paint and decals used make this harder etc 	8	<p>Points could relate to stages of LCA or sustainability</p> <ul style="list-style-type: none"> Raw material Manufacture of scooter Distribution/transportation Energy used during use Maintenance Disposal <p>Candidates should be drawing on examples or stages of life cycle to support their answer. If no examples are used, they should not be rewarded with marks higher than a Level 1.</p> <p>A candidate operating at Level 3 should be accessing all AO4 marks and at least two of the AO3 marks analysing/evaluating stages of the LCA.</p> <p>A candidate operating at Level 2 could be accessing marks in a variety of ways: All/most AO4 marks with limited analysis or evaluation (AO3), or a clear analysis and evaluation around the impact on the environment at various stages of the LCA.</p> <p>A candidate operating at Level 1 will be accessing AO4 marks, but no AO3 marks.</p>	<p>Level 3 (6–8 marks) The candidate will demonstrate an excellent understanding of sustainability and/or LCA stages and their impact on the environment when products are introduced. They will be able to discuss this convincingly, using examples of and/or evaluate the impact at specific stages of LCA.</p> <p>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated with the use of examples.</p> <p>Level 2 (3–5 marks) The candidate will demonstrate some knowledge of sustainability and/or LCA stages and their impact on the environment. They will be able to discuss this, using example(s) and examine its impact on the environment during use.</p> <p>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence/examples.</p> <p>Level 1 (1–2 marks) The candidate will give a basic answer showing limited understanding of sustainability and/or LCA stages and their impact on the environment. Any examples given may not be appropriate. Any attempt at analysis or evaluation of the choices made will be limited and not be worthy of credit.</p> <p>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</p> <p>Level 0 (0 marks) No response or no response worthy of credit.</p>

Question	Answer	Mark	Guidance
2 (b) (ii)	<p>Minimum number of oak blocks = 21</p> <p>Look at answer given in 2b(i) and apply ECF</p> <p>Calculated using area: Area of tabletop = 2025* Area of block 200x50=10,000 mm² converted to cm = 100 cm² 2025/100 = 20.25 = 21</p> <p>Award 1 mark for : 200 x 50 / area of table from 2bi (ECF) Award 2nd mark for correct answer from above</p> <p>Alternative method: 18 full blocks needed Plus 9 x 50cm which can be made from 3 full blocks = 21</p> 	2	<p>Award 2 marks if 21 seen.</p> <p>If 21 is not seen is not seen and working show calculation by area allow error carried forward for their area from 2bi</p> <p>*ECF: Allow their area from 2bi</p> <p>Award 1 mark if conversion mm/cm for block is not done or incorrect but correct method is seen.</p>

Question		Answer	Mark	Guidance
2	(c)	<p>One from e.g.:</p> <p>Ash, beech, birch, mahogany, teak</p> <p>Award credit for any other named hardwood.</p>	1	<p>Do not accept oak (given in question).</p> <p>Answers must be a hardwood.</p> <p>Allow balsa</p>
2	(d) (i)	<p>Correct dimensions taken from Fig. 2:</p> <ul style="list-style-type: none"> • Length = 45 • Width = 45 • Height = 45 + 5 = 50 <p>(Height includes frame 45 + tabletop 5)</p> <p>Volume (Length x Width x Height) 45 x 45 x 50 =</p> <p>Minimum volume = 101,250 (2)</p> <p>Unit = cm³ (1)</p> <p>Accept other answers with the correct unit e.g. 0.10125 (1) m³ (1)</p>	3	<p>Award 2 marks for correct minimum volume. Award 1 mark for the correct unit.</p> <p>Award 2 marks: If height of tabletop not included e.g., 91,125 (1) cm³ (1) 0.092 (1) m³ (1)</p> <p>Award 1 mark: If understanding of calculating volume is shown lwxh</p> <p>PE to check other answers with correct unit at SSU and update mark scheme as appropriate.</p>
2	(d) (ii)	<p>One from e.g.:</p> <ul style="list-style-type: none"> • helps protect the table from damage • strong due to the corrugation structure • lightweight due to the corrugation structure • widely available material • can be made from recycled card • can be recycled easily • resistant to impacts • easy to cut and fold <p>Award credit for any other appropriate response.</p>	1	<p>Do not award marks for light (on its own) as could refer to colour.</p> <p>Do not accept generic terms eg. Strong, durable, cheap, light without qualification/explanation.</p>

Question	Answer	Mark	Guidance						
2 (e)	 <p>The drawing shows three views of a square object on a grid. The Plan View is a square. The Front View shows a square with a double-line border, dimensions of 45 by 45, and a 2-unit gap between the border and the outer edge. The Side View shows a square with a double-line border and a 5-unit gap between the border and the outer edge. Red checkmarks are placed above the Side View, and a red '4' is written at the bottom right of the drawing area.</p>	4	<p>Plan</p> <ul style="list-style-type: none"> One mark for correct size and alignment <p>Side view</p> <p>Up to three marks for side view:</p> <ul style="list-style-type: none"> One mark for overall correct size One mark for alignment in drawing One mark for projected detail added (leg & table width) 						
3 (a) (i)	<table border="1"> <thead> <tr> <th data-bbox="271 719 786 767">Function</th> <th data-bbox="786 719 1151 767">Type of energy</th> </tr> </thead> <tbody> <tr> <td data-bbox="271 767 786 847">The mechanism is wound up and stores energy.</td> <td data-bbox="786 767 1151 847">Potential</td> </tr> <tr> <td data-bbox="271 847 786 954">The mechanism is released and the toy moves.</td> <td data-bbox="786 847 1151 954">Kinetic</td> </tr> </tbody> </table>	Function	Type of energy	The mechanism is wound up and stores energy.	Potential	The mechanism is released and the toy moves.	Kinetic	2	One mark for each correct answer
Function	Type of energy								
The mechanism is wound up and stores energy.	Potential								
The mechanism is released and the toy moves.	Kinetic								
a ii	<p>One mark for each correctly labelled motion</p>  <p>The diagram shows a toy duck on the left and a snail on the right. The duck has an arrow pointing right labeled 'Linear' and a curved arrow labeled 'Oscillating'. The snail has a circular arrow around its shell labeled 'Rotary'.</p>								

Question		Answer	Mark	Guidance
3	(b)	<p>One mark for correct identification: Gear / Cog</p> <p>One mark for description e.g.</p> <ul style="list-style-type: none"> • The gears are used to slow the stored energy released • The gears are used to turn / transfer rotary motion • Controls the speed of the duck • Makes the duck move <p>Award credit for any other appropriate response.</p>	2	Allow COG
3	(c)	<p>Up to two marks for a description or annotated sketch of how a cam and follower works. e.g.:</p> <ul style="list-style-type: none"> • The follower, follows the edge of the cam • The cam is shaped (eccentric or offset or pear shape) • As the cam rotates the follower moves up and down • They convert rotary motion into reciprocating motion <p>Award credit for any other appropriate response.</p>	2	<p>Cam rotates = 1 mark</p> <p>Follower goes up and down = 1 mark</p>

Question		Answer	Mark	Guidance
3	(d)	<p>Up to three marks e.g.:</p> <ul style="list-style-type: none"> • thermochromic pigment (1) changes colour with temperature (1) and would indicate if bath water was too hot or cold (1) • hydrochromic (1) polymer changes colour when wet (1) and would allow toy to change colour when used in the bath (1) • hydrophobic coating (1) repels water (1) from the surface and would keep any mechanism dry (1) • phosphorescent (1) material glow in the dark (1) would provide a nightlight in the bathroom (1) <p>Award credit for any other appropriate response. MUST BE A SMART or MODERN MATERIAL to get any marks.</p>	3	<p>One mark for identifying a specific smart or modern material suitable for a bath toy</p> <p>One mark for explaining how the smart material works/ is activated etc</p> <p>One mark for explaining how the smart material would improve the toy</p> <p>If material named is not a smart or modern material NO marks are awarded</p> <p>Answer must be appropriate for the context: bath toy</p>
3	(e)	<p>One mark for each reason. Two required. E.g.:</p> <ul style="list-style-type: none"> • Batteries run out and need replacing • batteries could get damaged by water • Replacing batteries can be expensive • It's a free source of energy (wind-up) <p>Award credit for any other appropriate response.</p>	2	<p>Do not accept answers relating to batteries being unsafe / dangerous / risk of electrocution etc.</p>

Question			Answer	Mark	Guidance
4	(a)	(i)	<p>One from e.g.:</p> <ul style="list-style-type: none"> • It absorbs moisture and is cool / lightweight to wear • It is comfortable to wear • It can be washed easily • It can be dyed different colours <p>Award credit for any other appropriate response.</p>	1	<p>Answer must be appropriate for the context: uniform in a fast-food restaurant</p> <p>Do not accept warm</p>
4	(a)	(ii)	<p>Any one from:</p> <ul style="list-style-type: none"> • Wool/Angora/Alpaca wool/Camel hair/Mohair/Yak wool • Silk • Coir/Coconut hair • Flax/Ramie • Hemp • Jute/Sisal/hessian • Cashmere/Linen/Leather <p>Accept other named natural fibre.</p>	1	<p>Do not accept Cotton as it is given in the question.</p>
4	(b)		<p>One mark for each example. Two required. E.g.:</p> <ul style="list-style-type: none"> • Bag for life • Refills for toiletries and food/ drinks • Plastic free isles in supermarket • Use of compostable plastic and packages bags <ul style="list-style-type: none"> • e.g. bio bags/biopak • Introducing re-worn and recycled clothing ranges • Bottle return schemes/ for polymers and glass • Clothing hire schemes for dresses and suits • Source products / ingredients locally • Use electric vehicle for deliveries • Use solar power / wind power to run the store <p>Award credit for any other appropriate response.</p>	2	<p>Answer must be appropriate for the context: online or instore retailers</p>

Question		Answer	Mark	Guidance
4	(c)	<p>Up to two marks for a description.</p> <ul style="list-style-type: none"> • Sensing circuits could be activated by pressure/movement or light (1) when activated it activates a circuit and acts as a switch/input (1) in the sensing barrier switching on an alarm. • An input is sensed (1), and this acts as a switch and activates (1) a circuit e.g. light, pressure, movement, heat etc <p>Award credit for any other appropriate response.</p>	2	
4	(d)	<p>Up to three marks for an explanation e.g.:</p> <ul style="list-style-type: none"> • White is a neutral colour • It can create a feeling of space / larger than it is • It can brighten up an area • White creates a clean look • Creates a minimalistic look • Merchandise will stand out well in a white space / it will not detract from items being sold • Colour can attract people and have meanings, different colour ways in products can increase sales • White is a fashionable colour for many products such as clothing, trainers, electronic gadgets etc <p>Award credit for any other appropriate response.</p>	3	<p>One mark for each valid point or additional marks for points that are explained further.</p> <p>Answers could cover white being used in retail environment (as per Image C) but can also cover colours more widely e.g., Meaning, complimentary colours etc.</p>

Question		Answer	Mark	Guidance	
				Content	Levels of response
5	(a)	<p>Egg box & sleeve - (papers and boards) – paper pulp, shredded and soaked to form pulp, moulded to shape and oven dried</p> <p>Hessian Shopping bag – (fibres and fabrics) folded edges to avoid fray are sewn together and double stitched using a sewing machine</p> <p>Barcode Scanner- (design engineering) PCB circuit board, etched copper board and surface mounted and soldered components</p> <p>Display Sign gripper - (polymers) extruded , polymer pellets fed along an archimedian screw and heated then forced through a die making a continuous profile – cut to length</p> <p>Shopping trolley- (metals) cut to length, bent using formers and held in place using jigs to be spot welded</p> <p>Wooden crate- (timbers) sawn to length, drilled and dowel jointed, clamped in palce to dry</p>	12	<p>Candidates can refer to manual, machine or CAD/CAM processes, but they must be appropriate for industrial manufacture.</p> <hr/> <p>A candidate operating at Level 3 could be accessing marks in a variety of ways. All but one of the AO4 marks and at least one of the AO3 marks for planning their approach, or all AO3 marks and at least six of the AO4 demonstrating a broad knowledge and understanding of principles related to commercial production. Diagrams should be clear and labelled to access level 3 marks.</p> <p>A candidate operating at Level 2 could be accessing marks in a variety of ways, but they should cover at least one of the AO3 marks for planning their approach and at least four AO4 marks, that sufficiently demonstrate enough of their knowledge and understanding of principles related to commercial production. Diagrams maybe limited or lack full detail.</p> <p>A candidate operating at Level 1 could be accessing marks in a variety of ways. They have not undertaken any analysis of the information on the</p>	<p>Level 3 (9-12 marks) The candidate has fully analysed the information given on the insert recognising all details required for making their chosen product commercially. Their process description will be comprehensive a demonstrating excellent understanding of the commercial manufacture process.</p> <p>The candidate response will be fully detailed using appropriate terminology, demonstrate an excellent understanding of the commercial manufacturing techniques and processes required to make their chosen product commercially. They will demonstrate a thorough knowledge of how to work with specific tools and application of digital technology should be used (if appropriate). They should be clear on how to ensure a completely accurate outcome.</p> <p>Specific materials/components and processes will have been clearly identified that are fully appropriate for both the processes being used and the product being commercially produced.</p> <p>Level 2 (5-8 marks) The candidate has adequately analysed the information given on the insert in that they have recognised some details required to make the product commercially. Description of processes will be clear demonstrate a good understanding of the commercial manufacturing process</p>

	<p>step-by-step plans with labelled diagrams and description production methods is needed.</p> <p>A step-by-step plan should follow an appropriate order and should cover the following:</p> <p>Processes, techniques or skills, e.g.:</p> <ul style="list-style-type: none"> • Marking out using templates/ jigs • <i>wasting methods</i> used to cut the materials (with allowances / tolerances as appropriate) – including accurate use of specific tools. • <i>deforming and reforming methods</i> used to shape/mould or strengthen materials and/or components – including accurate use of specific tools or equipment. • <i>methods of addition</i> used to join materials and/or components • how to ensure accuracy using jigs, templates and moulds. <p>Tools and digital technology, e.g.; all tools required to fulfil the processes and techniques being used.</p>	<p>insert, or planned their approach (AO3), but demonstrate some understanding of the materials and/or processes used to make a prototype(s), or they have done some analysis of the information (AO3) but have not demonstrated much knowledge of the materials or commercial manufacture process. Diagrams will lack clarity or annotation/ description – or may not be used at all.</p> <p>If description given is not related to commercial manufacture (eg. Made in workshop) then a maximum of Level 2 must only be awarded.</p>	<p>The candidate's response will offer some detail and use of appropriate terminology to demonstrate adequate understanding of the commercial manufacturing techniques and processes required to make their chosen product; diagrams may support this. They will demonstrate a good knowledge of how to work with tools that may not always be specific and digital technology may be used (if appropriate). They should have some understanding of how to ensure accuracy in their outcome.</p> <p>Most specific materials/components and finishes should have been identified that are mostly appropriate for both the processes being used and the product being commercially produced.</p> <p>Level 1 (1–4 marks) The candidate has not fully analysed the information given and/or planning is limited or not evident showing little knowledge of the commercial manufacturing processes.</p> <p>The candidate's response will lack any details and demonstrate a limited understanding of the manufacturing techniques and/or processes required to make their chosen product commercially. The response will demonstrate a basic level of knowledge of the candidate this may be in relation to their own workshop experiences and knowledge of tools and processes rather than a commercial level of production.</p> <p>Specific processes and techniques may not be fully appropriate or identified.</p>
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Product	Specific materials and components	Processes, techniques or skills
Product 1: Egg box/ sleeve (papers and boards)	Egg box/ paper sleeve	Recycled paper/card is shredded in a mechanical pulper and mixed with hot water – it swells fibres and turns to pulp and filters any impurities. Moulds are dipped in a vat and a vacuum sucks the pulp they are then transferred to another mould which is lubricated so they don't stick and then oven dried to evaporate the water. Or pulp could be sprayed onto a mould and then oven dried. Moulds made of aluminum or polymer covered with mesh. Sleeve is printed - most suitable method is flexography/offset lithography, cut and glued.
Product 2: Hessian shopping bag (fibres and fabrics)	Hessian bag with handle	Pattern is cut out for bag shape and handle, patterns used. Fabric is cut to shape, layers of fabric are held together with a folded edge to stop fraying, and straight stitch machine sewn with industrial sewing machine For handle two layers are cut then sewn (double stitching of seams) Handle is stitched to the bag and reinforced edges creates strength
Product 3: Barcode scanner (design engineering)	Hand scanner Surface mounted PCB circuit in an injection moulded casing	PCB board produced by photo etching, Print the circuit board and using UV light expose the copper board then etch this is usually ferric chloride solution -board in the acid tank for about 20 minutes until the copper traces are completely etched. You can tell that it's finished when the board turns from opaque pink to transparent yellow. surface mounted components using pick and place method, held in place by a sticky solder paste then soldered in a reflow soldering oven and assembled into an injection moulded casing held in place by screws.
Product 4: Display sign gripper (polymers)	Extrusion	Polymer granules/pellets are poured into the machine through a hopper. The granules are heated and melted to liquid form as they are carried along the barrel by a screw thread. The piston is drawn back then released so the liquid plastic is pushed into the die, the process is continuous, and a uniform section is pushed through, lengths are created and cut to length. The Die is made from steel.
Product 5: Shopping trolley (metals)	Cut and formed Spot welded	Metal rods are cut to length using a power hacksaw or guillotine. The shape would then be bent using bending jigs and formers and held in place using jigs and spot welded to hold in place. Parts are assembled using nuts and bolts.
Product 6: Wooden crate (timbers)	Sawn, drilled assembled and clamped	Lengths are sawn to length using a circular saw/ crosscut saw. Jig is used when drilling holes for dowels to ensure they are in the same place, a pillar drill is used. Dowels cut to length or bought in, assembled glued and clamped while drying. Edges finished and an oil-based finish applied

Question		Answer	Mark	Guidance
5	(b)	<p>Up to two marks for each explanation. Two required. E.g.:</p> <p>Egg box & sleeve e.g., die/mould</p> <ul style="list-style-type: none"> • is made from a strong materials/aluminium/polymer/it won't wear out (1) means die can be reused repeatedly (1) • the accuracy of die (1) makes sure the mouldings are consistent in shape and size (1) • speeds up manufacture (1) allows batches to be made (1) <p>Hessian shopping bag e.g., patterns</p> <ul style="list-style-type: none"> • accurate marking out (1) keeps product size consistent (1) • Avoids waste (1) as patterns can be tessellated (1) • speeds up manufacture (1) allows batches to be made (1) <p>Barcode scanner e.g: PCB circuit board e.g., templates</p> <ul style="list-style-type: none"> • accurate marking out (1) limits human errors with circuits (1) • ensures accurate boards (1) speeds up place of components (1) • Ensures consistent application of solder (1) as it's a repeated process in same place each time (1) <p>Display sign gripper e.g. Die</p> <ul style="list-style-type: none"> • Made from steel/durable material (1) allows large batches as the die can be reused (1) • the dimensional accuracy of the die (1) makes sure the mouldings are consistent size with a uniform cross-section (1) • allows mass production (1) speeds up the manufacture process (1) <p>Shopping trolley e.g., jigs/formers</p> <ul style="list-style-type: none"> • used to shape metal (1) keep the product size consistent (1) • to hold in place for welding (1) ensures accuracy of making (1) • accurate mark and cuts (1) avoids waste (1) • Using jigs and templates to cut and form and assemble/ at various stages (1) speeds up the process of manufacture (1) <p>Wooden Crate e.g., jigs/formers</p> <ul style="list-style-type: none"> • to mark out & cut lengths (1) keep the product size consistent (1) • when assembling (1) ensures accuracy size across a batch (1) • avoids waste (1) various lengths can be cut easily in batches (1) • to cut, drill and assemble/ at various stages (1) speeds up the process of manufacture (1) 	4	<p>One mark for a reason, one mark for explaining that reason.</p> <p>eg. A jig means no measuring or marking out is required (1) which speeds up making time (1)</p> <p>A template ensures all pieces are exactly the same (1) so all the products are consistent (1)</p>

Question		Answer	Mark	Guidance
5	(c)	<p>Up to two marks e.g.</p> <p>Egg box & sleeve - monoque/ one piece structure/form (1) with folds/reinforced sections and shape provides a strong shell structure (1) The shape individually <u>spaces the eggs and protects them</u>. (1) The shape of boxes can be stacked without damage to eggs (1) Printed sleeve (1) gives information about the eggs size and where they came from (1)</p> <p>Hessian shopping bag – made of woven hessian (1) under and over/ lattice structure/ weft and warp of fabric provides strength (1) The handle is made of folded double layer for increased strength (1) reinforced edges make the bag and handle strong (1)</p> <p>Barcode scanner – Could refer to components within the circuit (1) and how they add functionality e.g. switches or resistors (1) or the moulded shell structure (1) one piece with reinforced sections (1) of ABS case – or laminated layers on PCB (1) makes the board stable (1)</p> <p>Display sign gripper – use of a one piece (1) _ moulded cross section provides strength (1). Reinforced and grip sections (1) _provide extra strength where the shape will take pressure (1)</p> <p>Shopping trolley – lattice frame structure (1) over and under provides strength (1) overall shell shape uses some triangulation as the base is smaller (1) with bent pieces reinforced areas on edge of frame (1)</p> <p>Wooden crate – dowel joints (1) create strength ensuring crate doesn't collapse/break (1). Construction of the timber lengths into rectangular shape with gaps (1) provides a large storage space to hold items and be carried by the user (1). Re-enforced corners (1) mean that crates can be stacked ontop of each other without collapsing (1)</p>	2	Answers should relate to <u>identifying</u> a form/structure or component and then <u>explaining</u> how it helps the product to function.

Question		Answer	Mark	Content	Level of response
5	(d)	<p>Explanation of sourcing of raw material into useable form may include.</p> <p>Paper pulp made from trees – trees are cut down (sustainable forests ensure replanting) raw wood chippings are pulped by soaking them in water and pulverising, the volume of water used is substantial. Pulp is pressed through a series of rollers to become paper. Chemical processes use caustic soda and sodium sulphate to break down wood fibres, some paper is bleached. Sometimes a mixture of recycled paper/card and new virgin wood are used to make pulp</p> <p>Hessian is made from Jute fibres which are eco-friendly, Jute grows quickly and does not need pesticides uses a lot less water than cotton, can be grown in lots of different environments all over the world. Hessian fabrics are coarse and are woven from Jute. Jute plants are cut and bundled when 15-20cm tall usually before flowering. The fibres are retted/ bundled into layers and immersed in cold water for about 20 days, they are then stripped and this is usually done by hand and hung to dry then bundled ready to be woven.</p> <p>Cotton fibre is harvested from the seed pod (boll) of the cotton plant, from July to November. Cotton picking is completed by hand OR machine. Once picked the cotton goes through a process of ginning, which separates the fibre from the seed. Raw cotton bales are dried to remove moisture fibres that could cause the fibres to clump. The dry fibre is passed through a gin stand, where circular saws are used to remove the fibre from the seed. The cotton bales are then cleaned and bleached many times before it can be spun into yarn.</p> <p>Components metals such as copper, nickel and silver/ minerals such as silicone or cobalt and polymers (to insulate) are used to manufacture</p>	6	<p>Candidates should present a clear explanation and understanding of the stages required to source and process their chosen raw material. If there is no evidence of an ordered description, e.g. a list of unordered points they should not be rewarded with marks higher than a Level 1.</p> <p>Candidates are not required to use sketches to support their answer. No marks should be awarded for the sketches themselves, but marks can be awarded appropriately for supporting annotation/ description.</p> <p>A candidate operating at Level 3 should be demonstrating an in-depth knowledge and understanding of principles related to sourcing and processing their raw material and make good use of appropriate technical vocabulary.</p>	<p>Level 3 (5-6 marks) The candidate demonstrates they have fully analysed the information given on the insert they have recognised and demonstrated an excellent understanding of the processes involved with sourcing and processing their raw material and will offer in-depth detail about and the processes involved with sourcing and processing their raw material.</p> <p>Level 2 (3-4 marks) The candidate has adequately analysed the information given on the insert in that they have recognised and demonstrated an understanding of the processes involved with sourcing and processing their raw material, providing some detail and the processes involved with sourcing and processing their raw material</p> <p>Level 1 (1–2 marks) The candidate has not fully analysed the information given in the Insert and offers limited detail and use of the processes involved with sourcing and processing their raw material</p> <p>Level 0 (0 marks) No response or no response worthy of credit.</p>

		<p>electronic components such as resistors or switches (see steel metal process on mark scheme) polymers. Copper/silver etc are mined before processed.</p> <p>PVC polymer produced from crude oil. After the oil has been extracted it is transported to a refinery. Fracking and drilling for oil can affect the environment and transporting oil can result in oil spills. Crude oil is fractionally distilled, and the chemicals needed to make polymers are obtained, catalysts are added to enable polymerisation the joining together of monomers. Distilled oil is shipped to a manufacturer, who creates polymer pellets.</p> <p>Steel made from iron ore. Ores are dug out of the ground by mining, but in order to be turned into a metal form that can be used they must be separated from whatever they are mixed with. This process is known as extraction. A mixture of iron ore and coal is heated in a blast furnace to produce molten iron, or pig iron, from which steel is made. Molten steel from the furnaces passes through continuous casters and is formed into slabs, and billets. The steel is then processed and rolled to form the tubular steel lengths.</p> <p>Pine wood When a tree has been cut down, it is cut roughly into boards, planks or veneer (conversion). Timber contains a lot of moisture, dried out before use, a process called seasoning. The planks of wood are stacked on top of each other so air can circulate between them and reduce the amount of moisture usually done outdoors, can take years but timber can be dried faster using a kiln.</p>			
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Question		Answer	Mark	Guidance
6	(a)	<p>Up to two marks for each reason explained. Two required. E.g.:</p> <ul style="list-style-type: none"> • Consumers are often loyal to brands (1) as they trust them for producing good quality products (1) • Brands can be fashionable (1) sometimes celebrity endorsed (1) • Consumers will align social and morally (1) with the ethics of a particular brand (1) <p>Award credit for any other appropriate response.</p>	4	<p>For each point: One mark for a reason, one mark for a suitable explanation.</p> <p>Do not accept: answers relating to copyright / companies can't steal their designs / to protect the design from being copied</p>

Question		Answer	Mark	Content	Level of response
6	(b)*	<p>Examples could include: Use of VR, AI, apps, QR codes, RTFD tags, self checkout and scanners, AR in window displays (Zara)</p> <ul style="list-style-type: none"> Robots used for cleaning floors and scanning shelves for gaps needing restocking to keep a clean and stocked up store Use of contactless payments and apps for ordering making purchasing faster Use of SMM and WeChat app to engage with customers and provide information on products QR codes to provide more information AI used in retail online and instore to demonstrate/try on products/ create personalised adverts RFTD tags on clothing and other products to help marketing and targeting of personal adverts <p>Examples of might be given to support response:</p> <ul style="list-style-type: none"> Pay With Me in M&S allows customers with a small number of items to check out while queuing with an assistant. Lush use an app to interact with products and get more information when in store Amazon exploring stores that are unmanned – with smart security system that identifies products on a person that have not been paid for and will not let the individual out of the store until they have replaced it on the shelf. Audi Cars VR experience configure car, as well as explore the car's exterior and interior in realistic detail. 	8	<p>Focus needs to be on shoppers' experience If Security tags on items and sensors might be mentioned but it would be expected to be exemplified and related to shopper/ customer experience).</p> <p>As a guide for full marks there will be two or three examples of how technology is used discussed. Answer should demonstrate an understanding of what importance technology has and how this is applied to retail environments and customer experiences and will include judgement. Examples only will gain a maximum of 4 marks. AO3 is analysis, compare, discuss this will be the relation between consumer, retailers and technological product/systems. AO4 is knowledge and understanding - 4 marks for use of examples 2 marks for showing understanding in depth.</p>	<p>Level 3 (6–8 marks) The candidate demonstrates a good understanding of the impact of new & emerging technologies on a customer's retail experience, and how this is applied in reality. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated with the use of examples.</p> <p>Level 2 (3–5 marks) The candidate demonstrates some understanding of the impact of new & emerging technologies on retail experience for customers both instore and online has on retail and how this is applied in reality. There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence or examples.</p> <p>Level 1 (1–2 marks) The candidate demonstrates a limited understanding of the impact of new and emerging technologies to the customers retail experience both instore and/or online. The information is basic and communicated in an unstructured way. The information is supported by limited evidence/examples and the relationship to the evidence may not be clear.</p> <p>Level 0 (0 marks) No response or no response worthy of credit.</p>

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