GCSE

Design and Technology

J310/01: Principles of design and technology

General Certificate of Secondary Education

Mark Scheme for June 2023

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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
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor 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 RM Assessor 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 RM Assessor 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 RM Assessor 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.

Rubric Error Responses – Optional Questions
Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

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 RM Assessor **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 RM Assessor 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:
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **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

12. Subject Specific Marking Instructions

INTRODUCTION

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:

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.

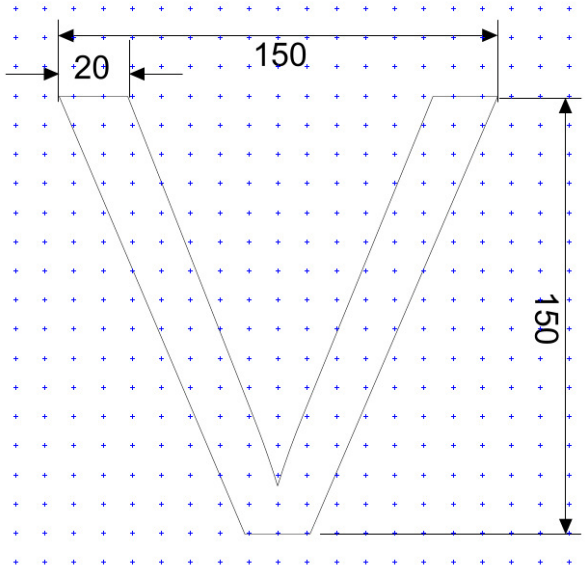
Be prepared to use the full range of marks. Do not reserve (e.g.) highest level marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the level descriptors, reward appropriately.

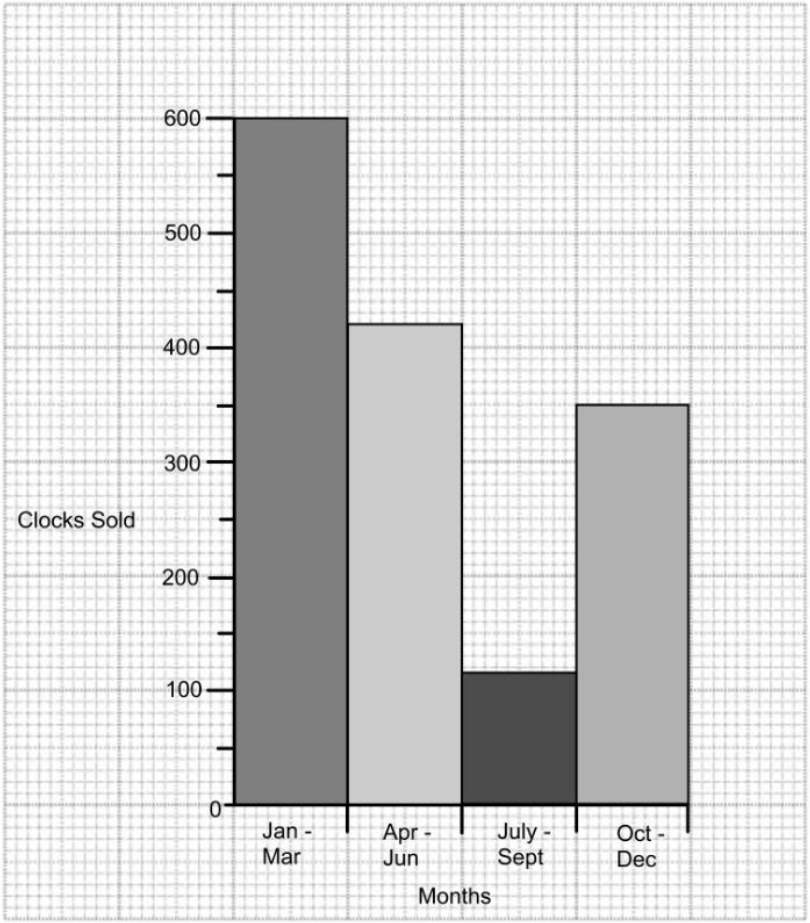
Question			Answer	Mark	Guidance
1	(a)	(i)	Synthetic fibres/fabrics are manmade /made from oil/coal/minerals/chemicals (1) Not natural / organic (1)	1	
1	(a)	(ii)	**One** from eg:: • Acrylic • Polyester • Neoprene • Lycra • Spandex • Nylon Accept any other synthetic fabric	1	
1	(a)	(iii)	Any **two** from eg: • The fabric is durable, the material will not tear easily • The case can be easily wiped down if it gets dirty • The material is stain-resistant • The material is lightweight so easy to lift and carry • Waterproof so clothes will stay dry Accept any other valid reason	2	Answers must relate to how synthetic fabric is suitable for the **suitcase.** Do **not** accept durable / strong / lightweight unless qualified. Do **not** accept: cheap / available in different colours
1	(b)		Any **two** described points eg:: • It makes manufacture faster (1) as the parts are bought in (1) • It helps to ensure quality and consistency with the manufacture (1) with less chance of human error (1) • It makes the cost of the product lower (1) as there are less steps to manufacturing (1) • Standard components can be cheap when bought in bulk (1) so the final product is cheaper to make (1) • Readily available can be bought from different suppliers • Can be used in many different products due to interchangeability	4	Answers must relate to **manufacture** rather than user benefits Do **not** accept: cheap on its own without justification (when bought in bulk)
1	(c)	(i)	Minimum **670** (mm) **(1)** Maximum **830** (mm) **(1)**	2	

1	**(c)**	**(ii)**	• This means the smallest woman and the tallest man would be able to use the case (1) • Suits everyone / fits everyone from smallest to largest (1)	**1**	Accept answers that explain choice for their answer in showing an understanding of anthropometrics.
1	**(c)**	**(iii)**	**100** (mm) **Accept answers 100-150** as suitable size to allow for 95th percentile man	**1**	
1	**(c)**	**(iv)**	**Two** from eg: • The handles have rounded edges or are made from soft material/ comfortable to hold • The case uses a zip pull/ easy to close with zip • The case is lightweight so easy to carry • The case has wheels so is easy to pull along • Multiple pockets for extra storage • Feet keep it stable and upright when not being pulled • Side handles make it easy to lift and carry • Zip handle size make it easy to open zips • Zip brightly coloured so easy to see	**2**	Must provide a feature of **the suitcase** that relates to an ergonomic feature e.g. Ease or comfort of use Do **not** accept **height adjustable** handle

Question			Answer	Mark	Guidance	
					Content	Levels of response
1	(d)		Answer could include: Ergonomics relates to any aspect of the interface between humans and the products/systems they interact with. Answers must relate to humans interacting with products and must cover why this is important in the design of products. e.g.: • User comfort • Ease of use • Ease of understanding • designing for extremes and adjustability • Use of colour if related to how it aids understanding and/or use • Forces required to operate, push, pull etc. • Layout of buttons • Size of text and fonts on screens/packages etc. • Use of anthropometrics to improve ergonomics for a wider audience, • Consideration of different ages/genders, possibly consideration those with disabilities. If ergonomics is not considered the products may not: • be suitable for the users they are being designed for which may mean the product does not sell or people return the products	6	Examples used could relate to any material area and may be examples of both good and bad consideration of ergonomics. .	**Level 3 (5-6 marks)** The candidate will demonstrate sound knowledge and understanding of ergonomics and its importance in the design of products. They will be able to undertake a thorough evaluation of the importance of considering ergonomics when designing products. A variety of relevant examples are used to effectively support the discussion. **Level 2 (3-4 marks)** The candidate will demonstrate sound knowledge and understanding ergonomics and its importance in the design of products There will be a basic attempt to evaluate the importance of considering ergonomics wen designing. It may not be wholly relevant to products. Evaluations might be one sided, identifying positive or negative implications or limited to evaluating one factor. Some relevant examples are used to support the discussion. **Level 1 (1–2 marks)** The candidate will show limited knowledge of what ergonomics is. There will be basic or no reference to understanding why considering ergonomics is important when designing products. There is no attempt at evaluation. If examples are used to support the discussion they may not be relevant. **Level 0 (0 marks)** No response or no response worthy of credit

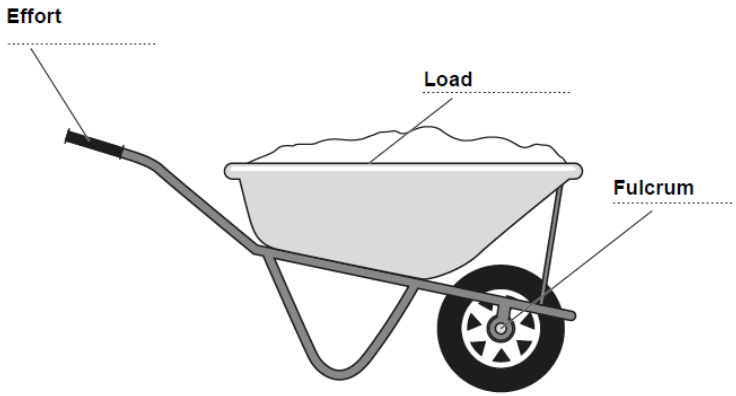
Question			Answer	Mark	Guidance
2	(a)	(i)	Using π = 3.142 gives C= 3.142 x750 = **2356.5** (mm) To allow for rounding or exact value of π from calculator: Accept any answer between **2356 – 2357** (mm)	1	
2	(a)	(ii)	r = 75/2 = 37.5 r^2 = 37.5 x 37.5 = 1406.25 π x r^2 = 3.142 x 1406.25 = **4418.44** (cm^2) To allow for rounding or exact value of π from calculator: Accept any answer between **4417.86 – 4420** (cm^2)	2	Award 2 marks if correct answer seen or Award 1 mark if incorrect radius has been used or if final answer is in mm^2 441843.75mm = 1 mark 1767375cm = 1 mark
2	(a)	(iii)	Scale 1:5 / 750mm ÷ 5 = **150** (mm)	1	
2	(b)	(i)	Up to **two** marks e.g.: • ferrous metals contain iron [1] non-ferrous metals do not [1] • ferrous metals are magnetic [1] non-ferrous are not [1] • ferrous metals rust [1] non-ferrous metals do not rust [1]	2	Accept any combination eg. Ferrous metals are magnetic /non ferrous metals do not rust
2	(b)	(ii)	**One** from eg: • aluminium • copper • tin • silver • nickel • lead • gold Accept any other named **non-ferrous** metal	1	

Question			Answer	Mark	Guidance
2	(c)	(i)	**Two** from eg: • enable accurate marking out • save time by making marking out faster • help keep quality consistent	2	Do not accept: easier
Question			**Answer**	**Mark**	**Guidance**
2	(c)	(ii)		3	1 mark for correct height (150mm) 1 mark for width overall (150mm) 1 mark for width of letter (20mm)

Question			Answer	Mark	Guidance
2	(d)	(i)		4	X and Y axis' drawn to appropriate scale **[1]** Both axes labelled appropriately **[1]** Bars drawn: **Two** correctly drawn bars **[1] or** **All** four bars drawn correctly **[2]** JAN/MAR - 600 APR/JUN - 420 JUL / SEP – 115 OCT/DEC – 350 Allow graph drawn in either direction (vertical or horizontal)
2	(d)	(ii)	600/1485 = **40 or 40.4** (%) $\frac{1485}{600}$ = 1 mark	2	Award 2 marks if correct answer seen or Award 1 mark if calculation is made using incorrect total sales figure.

Question			Answer	Mark	Guidance
3	(a)		Up to **two** marks for a description e.g. Motors provide rotary motion (1) when they receive electricity/ power (1) Rotates/Spins blades of fan (1) creating wind/air movement (1) Covert electrical energy (1) into mechanical energy (1)	2	1 mark for a statement, 2 marks for a description
3	(b)		Rotary / Rotation / Rotational	1	
3	(c)		**Two** from eg: • Mains electricity is usually reliable/consistent • Mains electricity is readily available in most homes/workplaces • Batteries will run out and need replacing • No need to wait for batteries to charge • Convenient as don't need to keep buying more batteries • More environmentally friendly as batteries don't end up in landfill	2	Do **not** accept cheaper without justification
3	(d)		**Two** sources from eg: • Wind power (1) turbine blades spin and generate electricity (1) • Solar Power (1) panels absorb and convert light to electricity (1) • Hydroelectric (1) water stored in a dam released turns turbines (1) • Wave Power (1) waves push air up into a cylinder to turn turbines (1) • Tidal Power (1) estuary movement of tide turns turbines (1) • Geothermal (1) cold water pumped through heated rocks turns into steam (1) • Biomass/ natural materials such as sugar cane/ wood (1) burnt to generate heat (1)	4	Up to **two** marks for each source. Two required: 1 mark for naming a source of renewable energy 1 mark for explaining how electricity is generated Do **not** accept windmill for wind power.

Question			Answer	Mark	Guidance	
					Content	Levels of response
3	(e)*		Discussion could include: Advantages • Fossil fuels are finite resources which means that are running out using renewable energy will help conserve fossil fuels. • Burning fossil fuels creates pollution from carbon whereas renewable energy are often low or zero carbon - increased use will reduce effect on environment and reduce global warming. • By increasing the use of renewable energy sources the UK will slowly reduce their carbon footprint and work towards government and COP26 targets. • Hydro power uses dams and is very reliable. It can also have a positive impact on the environment creating large reservoirs of water. Disadvantages • Renewable energy sources are sometimes powered by the weather e.g. solar power and wind turbines so can be unpredictable especially solar power in the UK. • Wind farms can create noise and “eye-sore” they take up space so cannot be used in areas that are densely populated. • Crops grown to fuel biomass can impact on nature and wildlife. • Hydro power can use tidal barrages and wave power equipment can be damaged in storms etc	8	Candidates should be drawing on examples of renewable energy sources to support discussion. If no specific examples are used, they should not be rewarded with marks higher than Level 1. .	**Level 3 [6-8 marks]** The candidate has a clear understanding of renewable energy sources. They produce a thorough discussion in relation to the question by explaining the advantages and disadvantages of using renewable energy sources. The explanation is clear and well-developed and specific examples are used. 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. **Level 2 [3-5 marks]** The candidate has a reasonable understanding of renewable energy sources. They produce a sound discussion in relation to the question by explaining some of the advantages and disadvantages of using renewable energy sources. The explanation of advantages and disadvantages is sufficient although one or two opportunities are missed in referring to different examples. There is a line of reasoning presented with some structure. The information presented for the most part relevant and supported by some examples. **Level 1 [1-2 marks]** The candidate has limited knowledge of renewable energy sources. Any reference to this issue is descriptive in nature and has little appreciation of the advantages or disadvantages of the increasing the use of renewable energy sources. The response contains no analysis or evaluation. The information has some relevance and is presented with limited structure or detail. The information is supported by limited examples. **Level 0 (0 marks)** No response or no response worthy of credit.

Question			Answer	Mark	Guidance
4	(a)			2	**Two** marks for **<u>three</u>** correct labels (effort, load and fulcrum **all** labelled correctly) **One** mark for **one or two** correct labels seen. NOTE: all three labels must be correct for two marks. Do not accept : E, L, F
4	(b)	(i)	**One** from eg: • available in different colours • weather resistant / waterproof • won't break easily if falls over • non biodegradable - won't break down when full of soil • won't soften in hot weather accept any other valid reasons	1	Answers must relate to the context: **garden plant pots** Do **not** accept recyclable Do **not** accept strong / durable unless qualified
4	(b)	(ii)	**One** from eg: • MF / melamine / melamine formaldehyde • UF/ urea formaldehyde • Polyurethane • Silicone • Bakelite • Epoxy resin Accept any named **thermosetting polymer.**	1	Do **not** accept resin on its own Do not accept thermos polymers eg. Polypropylene, PVC, HDPE, PMMA, acrylic, nylon etc.
4	(c)	(i)	**One** from eg:: • paper and paper pulp made from trees which are renewable (1) • will biodegrade/rot after use if thrown away (1) • will not cause pollution when disposed of (1) • paper pulp is often made from recycled paper/ card (1)	1	Do **not** accept 'recyclable'

Question			Answer	Mark	Guidance
4	(c)	(ii)	**One** from eg: • Pine • Redwood • Spruce • Cedar • Larch Accept any named **softwood**.	1	
4	(d)	(i)	**Two** from eg: • It reduces waste in landfill (1) • sometimes designs are unusual and its trendy/fashionable (1) • people feel good about repurposing or reusing products (1) • greater awareness about environmental issues (1) • uses less raw materials and resources (1) • can save money (1)	2	Answers must be about **upcycling**.
4	(d)	(ii)	Up to **two** marks for an explanation e.g. Upcycling takes a product/material used in a product and repurposes/creates a higher value more desirable product (1) – whereas recycling involves reprocessing materials /melting down/ shredding and remoulding (1).	2	

Question			Answer	Mark	Guidance	
					Content	Levels of response
5	(a)		**Product 1: Garden party decorations - (papers and boards)** card butterflies and flower decorations. Cut and butterflies embossed. **Product 2: Seat cushion pad - (fibres and fabrics)** machine sewn with buttonhole on strap, Quilted **Product 3: Solar powered LED strip light - (design engineering)** LED light strip encased in silicone. Moulded HDPE solar panel casing. **Product 4: Cube seat- (polymers)** HDPE moulded hollow cube seat. **Product 5: Watering can - (metals)** stamped and press formed, welded **Product 6: Garden table - (timbers)** sawn , drilled and bolted Allow step-by-step plans or description of one or two production methods. A step-by-step plan or description of a process that may be used to commercially manufacture the chosen product	9	Candidates can refer to manual, machine or CAD/CAM processes, but they must be appropriate for commercial manufacture. Candidates are not required to but may use sketches to support their answer. No marks should be awarded for the sketches themselves, but marks can be awarded appropriately for supporting annotation.	**Level 3 (7-9 marks)** The candidate demonstrates they have fully analysed the information given on the insert recognising all details required for making their chosen product commercially. Their process description will be comprehensive, demonstrating excellent understanding of the commercial manufacture process. The candidate's response will be fully detailed using appropriate terminology to 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). Materials/components and specific processes/finishes will have been clearly identified that are fully appropriate for both the processes being used and the product being commercially produced. **Level 2 (4-6 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. Their description of processes will be clear and demonstrate a good understanding of the commercial manufacturing process.

			Candidates can use diagrams to support this, it should follow an appropriate order and cover the following: Marking out, wasting, moulding, forming, assembly and finish, e.g.: • *Marking out methods* e.g. templates/jigs • *wasting methods* used to cut the materials (with allowances / tolerances as appropriate) – including accurate use of specific tools. • *deforming and reforming methods* used to shape/mould or strengthen materials and/or components – including accurate use of specific tools or equipment. • *methods of addition* used to join materials and/or components • *Finishing* techniques. **Tools and digital** technology, e.g.; all tools required to fulfil the processes and techniques being used.			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. 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). Materials/components and specific processes/finishes should have been identified that are mostly appropriate for both the processes being used and the product being commercially produced. **Level 1 (1–3 marks)** The candidate has not fully analysed the information given in the Insert showing limited knowledge of the commercial manufacturing processes. The candidate's response will lack 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 and this may be in relation to their own workshop experiences and knowledge of tools and processes rather than a commercial level of production. Specific processes/finishes and techniques may not be fully appropriate or identified. **Level 0 (0 marks)** No response or no response worthy of credit.

Specific techniques	Processes, techniques or skills
Product 1: Garden party decorations - (papers and boards) card butterflies and flower decorations. Cut and butterflies embossed.	Could be laser cut – drawn on CAD/ tessellated and laser cut – steps should be explained to include tessellation of drawings, setting of speed and feed or use of a template to mark, hand cut with a craft knife. UV varnish applied by spraying. Embossing card is placed between a male and female former and heat and pressure is applied – the card takes the shape of the die
Product 2: Seat cushion pad - (fibres and fabrics) machine sewn with buttonhole on strap, quilted	Lay plans drawn on CAD, pattern is cut out for cushion shape and straps multiple sheets using band saw. Layers of fabric are held together with a folded edge to shop fraying, overlocker and straight stitch machine sewn with industrial sewing machine For straps two layers are sewn (double stitching of seams) buttonhole sewn Quilting of cushion could be done by hand or machined - interlining – polyester filling – stitching to create quilted/upholstered effect Straps are stitched to the cushion a cross shape/
Product 3: Solar powered LED strip light - (design engineering) LED light strip encased in silicone. Moulded solar panel casing.	LEDs and other components together on a reel and arranged in layers for pasting and soldering – The layers are then vacuum sealed in silicone strip that has been extruded Polymer casing created by injection moulding. Polymer pellets are placed in a hopper and then heated plastic injected into a mould through a feed/archimedean screw and forced into the mould, once cooled it opens and ejector pins push the moulded piece out and it closes again and cycle repeats. The Die/ Mould is made of steel. Continuous process
Product 4: Cube seat- (polymers) HDPE moulded hollow cube seat.	Rotational moulded Mould created made from aluminum or GRP Plastic powder placed in machine – measured amount Heated mould is rotated. Liquid plastic coats the inside of the mould until no powder left creating even thickness cooled and opened – moulding removed and circle cut with a cutting tool to allow circuit to fit inside
Product 5: Watering can - (metals) stamped and press formed, welded	Mild steel sheet stamped to shape for body, spout and base – can shape for body and spout, shape stamped out as a blank, rolled to shape body and spout and handle is stamped and folded and press formed/ crimping on edges, TIG welded together
Product 6: Garden table - (timbers) sawn or routered, drilled and bolted	Lengths are sawn to length using a circular saw/ crosscut saw or router. Jig is used when drilling holes for coach bolts to ensure they are in the same place, a pillar drill is used. Edges finished using a router and sanding assembled bolted together.

Question			Answer	Mark	Guidance
5	(b)		Up to t**wo** marks for each explanation e.g.: • Use of a die/moulds/formers (1) allows batches to be formed or shaped accurately (1) • Use of patterns/ templates (1) keep the product size consistent/ accuracy of shape and size (1) • Use of jigs (1) ensures accuracy of shape and size when assembling or drilling/cutting (1) • Quality control checks (1) during manufacture at various stages (e.g. marking, cutting, assembly (1) • Quality control checks (1) of final product (1) • Use of CAD/CAM (1) guarantees consistency as repeats process exactly (1)	4	One mark for a method One mark for explaining how it ensures consistency/quality Answers may directly relate to a stage of their product, but responses will cover the aspects listed
5	(c)		Up to **two** marks for an explanation e.g. • acrylic sealed paper – provides a waterproof coating (1) for the party decorations that also protects colour fade in sunlight and/or resistance against rain (1) • Silicone strip housing seals circuit and makes a waterproof cover (1) that is durable for outdoor use in bad weather (1) • Cotton canvas cover is Nikwax/ waterproof treated (1) so repels rainwater and moisture (1) filling is polyester (1) so will not rot/degrade (1) • high density polyethylene (HDPE) provide resistance to water / mould/ mildew (1) that might cause discoloration/ staining/ keeps circuit dry (1) • zinc plated steel watering can –zinc coating provides resistance against rust (1) protecting against weather (1) • Tanalised wood provides water and mould/mildew resistance (1) against bad weather (1)	2	

Question			Answer	Mark	Guidance	
					Content	Levels of response
5	(d)	(i)	Explanation could include eg: • Sourcing of raw materials and processing/converting into a useable form and the impact it has on the environment at stages outlined below • Raw materials are extracted or harvested. • Raw materials then go through a number of manufacturing steps until material is a useable form. • Processing raw materials involves transforming raw materials by chemical or physical processing methods, for example, smelting and converting ores into usable materials, making polymers from oil. • Product might use energy during use • Recycling and disposal at end of useful life	6	Candidates should present an explanation to show knowledge and understanding of the stages required to source and process their chosen material/surface finish and the energy that is used and the impact this has on the environment. Transportation, energy during life and disposal should also be considered. All stages extraction, manufacture and disposal/ end of life should be considered for level 3 marks to be awarded.	**Level 3 (5-6 marks)** The candidates will demonstrate an excellent understanding of the processes required to source and convert their chosen material/surface finish into a useable form and the environmental impact this has during manufacture, transportation, use and disposal or recycling at end of life. Their explanation will be in-depth, using appropriate terminology and show a clear and logical understanding of the required stages to process the raw materials into a useable form and the environmental impact this has during manufacture, transportation, use and disposal or recycling at end of life. All stages are considered. **Level 2 (3-4 marks)** The candidates will demonstrate some understanding of the processes required to source and convert their chosen material/surface finish into a useable form. Their explanation will provide some detail, use mostly appropriate terminology and mostly show a logical understanding of the required stages to process the raw materials into a useable form and the environmental impact this has during manufacture, transportation, use and disposal or recycling at end of life. Not all stages are considered.

						Level 1 (1–2 marks) The candidates will give a basic answer showing limited understanding of the processes required to source and convert their chosen material/surface finish into a useable form and the environmental impact this has during manufacture, transportation, use and disposal or recycling at end of life. Not all stages are considered. Their response will lack detail and may be little more than a list of unordered points. **Level 0 (0 marks)** No response or no response worthy of credit.

Materials.	Impact on environment
Product 1: Garden party decorations - (papers and boards) card butterflies and flower decorations. card with a waterproof coating	**Card** is made from trees – raw wood chippings are pulped by soaking them in water and pulverizing. Chemical processes sometimes used to pulp and bleaches and dyes can also involve chemicals, surface finish will be sprayed onto sheets and is polymer based. Many of these forests will be in Northern Europe, Scandinavia or Russia. The trees will be cut down and transported to a factory to be turned into a pulp, transport uses energy. Trees will be replanted so this impact will be minimized if from sustainable forests. After the products useful life, which could be quite short, it will end up either being recycled or disposed of in landfill. The recycling process can also use lots of energy and when recycling paper the fibres get shorter and weaker so the recycling process is not indefinite. The surface finish will make it harder to recycle so will probably end up in landfill.
Product 2: Seat cushion pad - (fibres and fabrics) cotton with a polyester stuffing	**Cotton** tends to be intensively farmed from the seed pod (boll) of the cotton plant and uses large volumes of water. Once picked, the cotton goes through the ginning process, which separates the fibre from the seed. Raw cotton bales are dried to remove any moisture. The cotton first goes through dryers to reduce moisture content and then through cleaning equipment. All processes involve the use of water and energy. Once cotton has been baled it is sent to a mill for spinning or weaving into fabric. Dyes, prints or special finishes are added.– chemicals – and heat / energy. **Polyester** fibres are polymers produced from crude oil. Oil extraction releases greenhouse gases, and harms habitats and the environment. After the oil has been extracted it is transported to a refinery. Distilled oil is shipped to a manufacturer, who creates polymer pellets. These are then manufactured into polyester fibres. During the product's life it may be cleaned and washed in a washing machine, using lots of water and energy. After its useful life, it will end up either being recycled or disposed of in landfill. In recycling, the polyester filling because it's synthetic will take time to break down and degrade, 100s of years. Primary recycling involves passing the textile product on and secondary and tertiary recycling processes can use lots of energy to wash and shred fabrics to make them into new items, such as padding for chairs and car seats. Where a product is made from more than one material like the mat with polyester padding it is likely to end up in landfill as it's often hard to separate.
Product 3: solar powered LED strip light - (design engineering) components and silicone strip HDPE casing for the solar power unit – glass and components for unit	**Components** metals such as copper, nickel and silver/ minerals such as silicone or cobalt and polymers (to insulate) are used to manufacture electronic components such as resistors or switches. Copper/silver etc. are mined before processed, mining can destroy habitats and cause chemicals/ use energy and cause pollution/ greenhouse gas during smelting process **HDPE polymer** produced from crude oil, which is made from fossil fuels and us running out. Fracking and drilling for oil can affect animal habitats, transported to a refinery uses fuel and if spilt can cause environmental issues. Crude oil is fractionally distilled, and the chemicals needed to make polymers are obtained, the process uses energy and causes pollution. Distilled oil is shipped to a manufacturer, who creates polymer pellets. During life its energy to

	power is solar and is sustainable. Mould made for manufacture, often doesn't take place in same factory. After use the product will probably end up in landfill as it contains numerous materials the polymers and circuit components will not easily degrade and will cause leachate/ toxins in soil
Product 4: cube seat- (polymers) HDPE	**HDPE polymer** produced from crude oil, which is made from fossil fuels and is running out. Fracking and drilling for oil can affect animal habitats, transported to a refinery uses fuel and if spilt can cause environmental issues. Crude oil is fractionally distilled, and the chemicals needed to make polymers are obtained, the process uses energy and causes pollution. Distilled oil is shipped to a manufacturer, who creates polymer pellets. Molds made for manufacture often doesn't take place in same factory. During life its energy to power is solar and is sustainable, the product will be cleaned regularly with detergent. After use the product will probably end up in landfill as it contains numerous materials the polymers and circuit components will not easily degrade and will cause leachate/ toxins in soil.
Product 5: watering can - (metals) Zinc plated mild steel	Steel made from iron ore. Ores are dug out of the ground by mining, this can affect habitats and create air pollution, 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 then heated in a blast furnace to produce molten iron, or pig iron, from which steel is made, this uses energy and creates pollution/ greenhouse gases. Molten steel fromthe furnaces passes through continuous casters and is formed into slabs, and billets. The steel is then processed and rolled to form sheets. Zinc plating involves processing (pickling, cleaning, and dipping) to apply a zinc coating, this uses chemicals and energy. The zinc coating makes recycling harder as zinc needs to be separated from the steel
Product 6: Garden table - (timbers) Pine wood tanalised	When the tree has been cut down, it is cut roughly into boards, planks or veneer (conversion). Timber contains a lot of moisture and needs to be dried out before use, a process called seasoning, sometimes this involves heat and energy. The planks of wood are stacked on top of each other so that air can circulate between them and reduce the amount of moisture, this is usually done outdoors, can take years but timber can be dried faster using a kiln, but uses energy. Shipping/transporting the material uses energy, the tanalising involves pressure impregnation in a chamber and uses chemicals and heat. tanalising prolongs the life of the product but wood will eventually rot.

Question			Answer	Mark	Guidance
5	(d)	(ii)	Up to **two** marks for an explanation e.g.: **Garden party decorations** • material could be changed to biopolymer (1) to have a longer life (1) • coating could be changed to a natural wax (1) that would biodegrade in time (1) • use recycled card (1) so no trees are cut down (1) **Seat cushion pad** • recycled material could replace the polyester filling (1) to reduce the use of non-renewable materials (1) • the cushion cover could be made removable (1) allowing it to be replaced or cleaned (1) **Solar powered LED strip light** • LEDs could be spread out more to use less components (1) reducing the use of materials/components (1) • The silicone strip could be designed to open and allow the circuit to be repaired if needed (1) reducing the likelihood of the product being disposed into landfill (1) • The casing could be manufactured from recycled material or a biopolymer (1) to reduce the use of non-renewable materials (1) **Cube seat** • The cube could be manufactured from recycled material or a biopolymer (1) to reduce the use of non-renewable materials (1) • The company could offer upgrades or repairs to the circuit (1) to reduce the likelihood of the product being disposed into landfill (1) **Watering can** • Aluminium or stainless-steel used (1) to make end of life recycling easier (1) • Use recycled metals (1) to reduce the amount of energy used in production (1) **Garden table** • Marine ply / green MDF could be used instead of tanalised pine (1) as no trees need to be cut down (1) • The designer could look to use less components (1) to reduce the amount of materials used (1) • Use thinner timber (1) so less wood is used overall(1) • Use wood joints instead of bolts (1) reduces use of metal / makes it easier to recycle • Use recycled wood (such as pallets) (1) to no trees need to be cut down (1)	2	One mark for a way One mark for explaining how it reduces its environmental impact. Responses should be explained – the way stated and explanation of how is needed for two marks Do **not** accept : make product smaller to lessen the amount of material used’

Question			Answer	Mark	Guidance
6	(a)		Up to **two** marks for each description. Two required. E.g. • Direct marketing via post/email to consumers (1) through use of fliers/leaflets/email adverts (1) • TV/video adverts/YouTube/tiktok) (1) this can reach consumers direct/show products in use (1) • Magazine adverts in specialist gardening magazine (1) to reach garden enthusiasts • Special offers/half price/BOGOF (1) to entice/attract shoppers/consumer to make a purchase (1) • Offer guarantee (1) so product can be returned if customer not satisfied (1) • Use of SMM/ product placement/ celebrity endorsement (1) to generate interest in the product (1) • Offer a free trial period (1) allows consumer/customers to experience before purchase (1) • Feature on a TV show about garden makeovers/garden design (1) to generate interest/awareness in the product (1) • Social media (1) adverts on facebook / Instagram / twitter etc. (1) Accept any other valid marketing methods.	4	Methods to market their chosen product to the **consumer** should be explained – the what and the why is needed for two marks Do **not** accept answers relating to marketing to shops/retailers/manufacturers Do **not** accept 'advertising' on its own.

Question			Answer	Mark	Guidance	
					Content	Levels of response
6	(b)*		Methods/ techniques of presenting developments and new products to **clients and stakeholders** could include: • Sketches, presentation drawings, working drawings • CAD models can be presented allowing designs to be viewed in 3D and rendered to show colours and textures • Use of VR/ AR can allow designs to be shown in context and interacted with • Physical models/ prototypes / handmade / 3D printed / rapid prototypes can be provided allowing retailers and stakeholders to test and use/ experience physical products before purchasing • ideas can be pitched or demonstrated in person or by video/ short films • graphical boards showing product in scenario or in use • Meetings / focus groups	8	As a guide for full marks there will be two or three examples of methods to presenting ideas to potential clients and stakeholders. .	**Level 3 (6 – 8 marks)** There is a well-developed line of reasoning which is clear and logically structured. The candidate demonstrates a good understanding of the methods of presenting ideas to potential clients and stakeholders and how this is applied in reality. The information presented is relevant and substantiated with the use of examples. **Level 2 (3 – 5 marks)** There is a line of reasoning presented with some structure. The candidate demonstrates some understanding of the methods of presenting ideas to potential clients and stakeholders and how this is applied in reality. The information presented is in the most-part relevant and supported by some evidence or examples. **Level 1 (1 – 2 marks)** The information is basic and communicated in an unstructured way. The candidate demonstrates a limited understanding of the methods of presenting ideas to potential clients and stakeholders. The information is supported by limited evidence/examples and the relationship to the evidence may not be clear.

			• Powerpoint presentations			**Level 0 (0 marks)** No response or no response worthy of credit.

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