

# Markscheme

May 2025

Design technology

Higher level and standard level

Paper 2

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## General Marking Instructions

### Subject Details: Design Technology HL and SL Paper 2 Markscheme

#### Mark Allocation

Candidates are required to answer **ALL** questions in Section A (total **[30 marks]**) ONE question in Section B **[20 marks]**. Maximum total = **[50 marks]**.

#### Markscheme format example:

Question			Answers	Notes	Total
4.	b	ii	the displacement and acceleration; are in opposite directions;	<i>Accept <b>force</b> for <b>acceleration</b>.</i>	2

- Each row in the “Question” column relates to the smallest subpart of the question.
- The maximum mark for each question subpart is indicated in the “Total” column.
- Each marking point in the “Answers” column is shown by means of a semi-colon at the end of the marking point.
- A question subpart may have more marking points than the total allows. This will be indicated by “**max**” written after the mark in the “Total” column. The related rubric, if necessary, will be outlined in the “Notes” column.
- An alternative wording is indicated in the “Answers” column by a slash (/). Either wording can be accepted.
- An alternative answer is indicated in the “Answers” column by “**OR**” on the line between the alternatives. Either answer can be accepted.
- Words in angled brackets < > in the “Answers” column are not necessary to gain the mark.
- Words that are underlined are essential for the mark.
- The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.
- If the candidate’s answer has the same “meaning” or can be clearly interpreted as being of equivalent significance, detail and validity as that in the “Answers” column then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **OWTTE** (or words to that effect).
- Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

12. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script. “ECF acceptable” will be displayed in the “Notes” column.
13. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the “Notes” column.

**Section A**

Question			Answers	Notes	Total
1.	a	i	constructive discontent; desire to help others; scientific curiosity; desire to make profit/money;	<i>Award [1] for listing the driver for invention, that motivated Yasin to create Petit Pli's<sup>®</sup> suit, [1max].</i>	1
1.	a	ii	Adaptation is when a solution to a problem in one field is used to provide a new idea for a design problem in another; The designer was inspired by origami style folding panels used in satellite/space design;	<i>Award [1] for each point in an outline on why adaptation is the strategy for innovation used for Petit Pli<sup>®</sup> clothing, [2 max].</i>	2
1.	b	i	Polyester; Nylon;	<i>Award [1] for each type of synthetic fabrics that can be converted from PET plastic, [2 max].</i>	2
1.	b	ii	High Elasticity; Allows the material to stretch/maintain its shape; High tensile strength; Allows the material to withstand pulling forces; Low absorbency; Will not take in/resists moisture; Good abrasion resistance; Makes the fabric more durable/long lasting; Quick drying; Will resist mould/mildew/easy care; High recyclability; Reduces waste/lowers environmental impact;	<i>Award [1] for identifying an advantage and [1] for a brief outline, [2 max].</i>	2

Question 1 continued

Question			Answers	Notes	Total
1.	c	i	Adjustability; The ability of a product to be changed in size (to increase the range of percentiles that a product is appropriate for);  Range of sizes; A selection of sizes means that the product caters for the majority of a market; Body measurements such as torso length /leg length /arm length; To ensure the clothing fits a wide percentile range /5th to 95th percentile;	Award <b>[1]</b> for identifying a consideration and <b>[1]</b> for a brief outline, <b>[2 max]</b> .	2
1.	c	ii	Disposal emissions for 7 jackets = 40 kgCO <sub>2</sub> eq; Emissions for 1 Petit Pli <sup>®</sup> garment= 5 kgCO <sub>2</sub> eq; Percentage reduction= $((40-5)/40) \times 100 = 87.5\%$ ;	Award <b>[1]</b> for identifying emissions for one Petit Pli <sup>®</sup> garment, <b>[1]</b> for the work out, and <b>[1]</b> for a correct answer, <b>[3 max]</b> .	3
1.	d	i	Utilization;  Maturity;	Award <b>[1]</b> for stating the lifecycle stage, <b>[1 max]</b> .	1
1.	d	ii	Waste reduction; Petit Pli <sup>®</sup> 's products reduce solid waste/CO <sub>2</sub> emissions by replacing the need for multiple garments with one expandable design;  The Prevention principle; Petit Pli <sup>®</sup> 's products avoids/minimizes environmental hazards/waste production, in relation to the production, use and disposal of a product;	Award <b>[1]</b> for identifying a green design principle and <b>[1]</b> for one specific form of it, <b>[2 max]</b> .	2
1.	e	i	Landfill;  Incineration/burning;  Ocean dumping;	Award <b>[1]</b> for each method of disposal that negatively affects the environment, <b>[2 max]</b> .	2
1.	e	ii	Cradle to cradle is a design philosophy that aims to eliminate waste from the production, use and disposal of a product;  Petit Pli <sup>®</sup> applies this by using recyclable PET/plastic bottles to manufacture the garments;  Resulting in products which are made to be made again/ support sustainable production/ reduces environmental impact;	Award <b>[1]</b> for each distinct point in an explanation on how Petit Pli <sup>®</sup> uses the cradle-to-cradle approach regarding the manufacture of their garment, <b>[3 max]</b> .	3

Question		Answers	Notes	Total
2.	a	<p>Solid model; An accurate representation of shapes/dimensions/materials/ exterior and interior of the model;</p> <p>Assembly drawing; A diagram that shows how components fit together to make a whole;</p>	<p><i>Award [1] for identifying a computer-generated model and [1] for one specific form of it, [2 max].</i></p>	2
2.	b	<p>Prototypes are a sample/model built to test a concept or process/act as an object to be replicated/learned from;</p> <p>Prototype can be used to test the functionality/to evaluate the mechanical action and suction performance;</p> <p>Prototypes can be developed at a range of fidelity/for different contexts/at low cost;</p> <p>Prototype can be used to gather user feedback on comfort/ergonomics while using the product;</p>	<p><i>Award [1] for identifying an advantage of creating a prototype of the OMIT<sup>®</sup> vacuum cleaner and [1] for a brief outline, [2 max].</i></p>	2
3.		<p>Design for Assembly (DFA) is designing by taking into account assembly at various levels;</p> <p>Component to component/components into sub-assemblies/sub-assemblies into complete product;</p> <p>By using standardized components;</p> <p>That simplify the process/reduce the costs (of assembly);</p>	<p><i>Award [1] for each distinct point in an explanation on Hiroyuki Morita using a 'design for assembly'(DFA) approach to build his early prototypes, [3 max].</i></p>	3
4.		<p>Dominant designs contain (implicit) features of a product that are recognized as essential by a majority of manufacturers/purchasers;</p> <p>The OMIT<sup>®</sup> vacuum cleaner is limited by its power/time it can be operated/ requires continuous manual effort;</p> <p>Making it less attractive/desirable in markets/ making it less convenient for users compared to electric alternatives/ reduces its effectiveness, especially for larger cleaning tasks/which can cause fatigue and reduce appeal;</p>	<p><i>Award [1] for each distinct point in an explanation on why the OMIT<sup>®</sup> handheld vacuum cleaner is unlikely to become a dominant design, [3 max].</i></p>	3

**Section B**

Question		Answers	Notes	Total
5.	a	<p>Blow moulding;                      Injection moulding;                      Compression moulding;                      Vacuum forming;</p>	<p><i>Award [1] for each method by which plastic products can be moulded, [2 max].</i></p>	2
5.	b	<p>Percentile ranges presents the proportion of a population with a dimension at, or less than a given value/Anthropometric data would have been gathered;                      It will be used to determine the interior dimensions, based on the 95th percentile;                      Ensuring the wheelbarrow's size will fit the widest range/majority of users comfortably;</p>	<p><i>Award [1] for each distinct point in an explanation on how the percentile ranges were used to determine the interior dimensions of the wheelbarrow to comfortably seat a human when used as a watercraft, [3 max].</i></p>	3
5.	c	<p><b>Target Market</b>                      Target Market is determined by focusing on specific demographics/segments and regions/sectors;                      The designers target a well defined/specific segment of consumers with common needs or wants/living in developing countries prone to floods;                      And planned to provide the barrow to users who would benefit from the product;</p> <p><b>User Needs</b>                      User needs are the essential requirements that a product must satisfy in relation to the user;                      The barrow was designed to fulfil 3 different requirements (a barrow, a vendor cart and watercraft);                      And also had to be comfortable/buoyant/safe/stable in flood situations;</p>	<p><i>Award [1] for each distinct point in an explanation on how the 'Target Market' was determined by the designers of the Utility Barrow, [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on how the 'User Needs' were determined by the designers of the Utility Barrow, [3 max].</i></p> <p><i>Mark as [3] + [3].</i></p>	6

Question		Answers	Notes	Total
5.	d	<p><b>Orthographic Drawing</b></p> <p>Orthographic drawing is a (scaled) 2-dimensional drawing;                      Showing front/top/side views with dimensions/measurements;                      To communicate with manufacturers (for production);</p> <p><b>Prototypes</b></p> <p>Prototypes are a sample/model built to test a concept or process/act as an object to be replicated or learned from;                      Prototypes can be developed at a range of fidelity/for different contexts;                      To provide feedback (from users) for further development/improvement;</p> <p><b>CAD Modelling</b></p> <p>CAD modelling involves the use of computers to aid the design process;                      CAD models can be easily/quickly modified;                      And communicated/shared between designers/manufacturers/clients;</p>	<p><i>Award [1] for each distinct point in an explanation on why the designers used 'orthographic drawing' to aid in the design of the Utility Barrow, [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on why the designers used 'prototypes' to aid in the design of the Utility Barrow, [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on why the designers used 'CAD modelling' to aid in the design of the Utility Barrow, [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	<p><b>9</b></p>

Question		Answers	Notes	Total
6.	a	<p>To preserve/protect the timber; From dry rot/fungal attack/insects/borers/damp environments;</p>	<p><i>Award [1] for applying treatment finishing solutions to preserve/ [1] for applying treatment finishing solutions to protect/ [1] for leading to an account [2 max].</i></p>	2
6.	b	<p>Renewability is the level to which a resource is renewable/the rate that a resource can be replenished (over time); Timbers from sustainably managed forests are regrown for future use; To ensure there is a continued supply of material/effective resource management/long term sustainability/reducing environmental impact;</p>	<p><i>Award [1] for each distinct point in an explanation on the concept of renewability and how it has been considered in the decision to use timbers from sustainably managed forests, [3 max].</i></p>	3
6.	c	<p><b>Practical function:</b> Practical function is mainly concerned with the aspect of performance/Puts function as the primary design goal; The Flow Hive<sup>®</sup> has a simple design that offers ease of use; Making it suitable for beekeeping beginners to understand how to harvest honey.</p> <p>Practical function is determined by the rational/logical/well-reasoned approached in its design; It is sold as a self-assembled kit with simple instructions; Resulting in a simple and intuitive setup and use of the hive;</p> <p><b>Psychological function:</b> Psychological function is concerned with the emotional attachment/response people have with products; The flow hive is designed for beekeeping, an activity that promotes emotional wellbeing/provides a sense of connection with nature; Which is enhanced by the inclusion of simple (visually/aesthetically pleasing) elements, such as the side observation windows/the use of natural treated softwood timber.</p>	<p><i>Award [1] for each distinct point in an explanation on how 'practical function' has influenced the design of the Flow Hive<sup>®</sup>, [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on how 'psychological function' has influenced the design of the Flow Hive<sup>®</sup>, [3 max].</i></p> <p><i>Mark as [3] + [3].</i></p> <p><i>Do not award marks across clusters.</i></p>	6

Question 6 continued

Question		Answers	Notes	Total
6.	d	<p><b>Process innovation</b></p> <p>An improvement in the method of manufacture/organization that often leads to reduced costs or benefits to consumers;</p> <p>Flow Hive© is manufactured using laser cutters and CNC machines;</p> <p>And is sent to consumers as a self-assembly kit;</p> <p><b>Sustaining Innovation</b></p> <p>Sustaining innovations are new or improved products that meet the needs of consumers and sustains manufacturers;</p> <p>The Flow Hive© is an improvement on traditional beehives/allows users to extract honey without disturbing the bees/offers a clean honey extraction system;</p> <p>Meeting the needs of modern consumers/beekeeping beginners/sustaining consumers' interests/which enabled the company to grow its customer base rapidly;"</p> <p><b>Product versions</b></p> <p>A business practice in which a company produces different models of the same product;</p> <p>Flow Hive© has applied this by offering multiple models (such as Flow Hive Hybrid, Flow Hive Classic, Flow Hive 2, and Flow Hive 2+), with different prices;</p> <p>Allowing the company to expand its customer base/target different customers' needs/budgets/ offering consumers a wider range of products to choose from;</p>	<p><i>Award [1] for each distinct point in an explanation on how the development of the idea for Flow Hive© could be considered as 'process innovation', [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on how the development of the idea for Flow Hive© could be considered as 'sustaining innovation, [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on how the development of the idea for Flow Hive© lead the company to developing different 'product versions', [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9

Question		Answers	Notes	Total
7.	a	<p>The lota water vessel can be found in almost all Indian homes; And has existed/been in circulation for a long time;</p>	<p><i>Award [1] for each point on why the traditional Lota water vessel is both ‘ubiquitous’ and ‘omnipresent’ in Indian culture, [2 max].</i></p>	2
7.	b	<p>Conceptual modelling is a model that exists in the mind, used to help us know and understand ideas/translates intangible (2D) ideas into tangible (3D) visualisations; It presents the filtration and waste process idea in a simple/easy to grasp way/ It realizes/demonstrates the functional and aesthetic qualities of the idea/concept/process; To help determining the required improvements/refinements for filtration system to be used as intended/ It can support the development of the filtration system by exploring form/construction/relationship of parts;</p>	<p><i>Award [1] for each distinct point in an explanation on the benefits of using conceptual modelling, [3 max].</i></p>	3
7.	c	<p><b>Recovery of raw materials</b> Is a strategy used for the separation of components of a product in order to recover raw materials; LOTA+™ seeks to find locally sourced materials left over from the building industry; To be utilized as the primary materials used to build their toilets;</p> <p><b>Circular Economy</b> An economy model in which resources remain in use for as long as possible; From which maximum value is extracted while in use; And the products/materials are recovered/regenerated at the end of the product life cycle;</p> <p>An economy model in which resources remain in use for as long as possible; LOTA+™ sources materials that can be used again; To reduce the quantity of materials that end up as waste/in landfill;</p>	<p><i>Award [1] for each distinct point in an explanation on how LOTA+™ has encouraged the recovery of the ‘raw materials’, [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on how LOTA+™ has encouraged the concept of a ‘circular economy’ in their design, [3 max].</i></p> <p><i>Mark as [3] + [3].</i></p> <p><i>Do not award marks across clusters.</i></p>	6

Question 7 continued

Question		Answers	Notes	Total
7.	d	<p><b>Design for materials</b></p> <p>Involves designing in relation to materials during processing;                      LOTA+™ source locally available/accessible/reclaimed materials;                      Minimizing the need to transport materials/reduce costs;</p> <p><b>Design for assembly</b></p> <p>Takes into account assembly at various levels (component to component/components into sub-assemblies/subassemblies into complete products);                      The LOTA+™ toilet is designed to be self-assembled;                      Using standard modular components;</p> <p><b>Design for manufacture</b></p> <p>Designers design specifically for optimum use of existing manufacturing capability;                      The toilet is built by the local community themselves;                      With basic tools and locally sourced materials provided;                      Built by communities requiring limited skill and tools;</p>	<p><i>Award [1] for each distinct point in an explanation on how the designers of LOTA+™ have considered ‘design for materials’, [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on how the designers of LOTA+™ have considered ‘design for assembly’, [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation on how the designers of LOTA+™ have considered ‘design for manufacture’, [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9