

# Markscheme

**May 2023**

**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;	Accept <b>force</b> for <b>acceleration</b> .	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.
- 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.
- 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	reduce fuel consumption; improve fuel efficiency; decrease dependency on fossil fuels; reduce levels of pollution; appeal to environmentally conscious users; to compete with other hybrid vehicles; to promote clean technologies;	<i>Award [1] for stating one reason why Volvo introduced a hybrid system.</i>	1
1.	a	ii	a dominant design contains features recognised as required/essential; the XC90 is considered the safest car on the market/has safety features adopted/used by other manufacturers;	<i>Award [1] for identifying why the XC90 is considered a dominant design and [1] for a brief explanation up to [2 max].</i>	2
1.	b	i	technology push; (scientific) research underpins new ideas/leads to advances in technology;  disruptive innovation; a product/technology that challenges existing companies to ignore/embrace technical change;	<i>Award [1] for identifying the strategy for innovation and [1] for a brief explanation up to [2 max].</i>	2
1.	b	ii	it is a product that can be found almost everywhere; seat belts are seen/used in all cars/vehicles;	<i>Award [1] for identifying why the seatbelt could be considered a ubiquitous classic design [1] for a brief explanation up to [2 max].</i>  <i>Do not accept 'seatbelts are required/essential in all cars/vehicles'</i>	2

Question 1 continued

Question			Answers	Notes	Total
1.	c	i.	air pollution; caused by incineration;  water/soil pollution; caused by leaching (hazardous) toxic chemicals (from landfill);	<i>Award [1] for identifying an environmental risk when disposing of batteries and [1] for a brief explanation up to [2 max].</i>  <i>Do not award marks between clusters.</i>	2
1.	c	ii	legislation enforces laws/regulations (to reduce the environmental impact of cars); for manufacturers to meet certain requirements/standards; which encourages/requires companies to develop clean technologies;	<i>Award [1] for identifying why legislation is used as a driver for the introduction of clean technology and [1] for each explanation up to [3 max].</i>	3
1.	d	i.	first generation;	<i>Award [1] for stating the generation of robot used for simple tasks such as drilling holes up to [1 max].</i>	1
1.	d	ii.	alloys can be lightweight; which reduces the amount of fuel needed;  alloys can have good thermal insulation; for effective functioning of the engine/exhaust system;  alloys can be corrosion resistant; which makes the (body of the) car more durable/less prone to rust/oxidisation;  alloys can have high (compressive) strength/be tough; ensuring vehicles are safer;	<i>Award [1] for identifying a reason why alloys would be used in the production of the Volvo XC90 and [1] for a brief explanation up to [2 max].</i>  <i>Do not award marks between clusters.</i>  <i>Do not accept 'alloys are strong/stronger'</i>	2

Question 1 continued

Question			Answers	Notes	Total
1.	e	i.	instrumented models can take measurements to provide feedback/analysis; without causing humans harm/injury/death during testing;	<i>Award [1] for identifying one reason why instrumented models would be used in the development of the XC90 and [1] for a brief explanation up to [2 max].</i>	2
1.	e	ii.	digital humans are computer simulations (mechanical and physical aspects) of the human body; they are used to test ideas in the CAD stage; and are cost effective/easy to implement/easy to modify;	<i>Award [1] for identifying an advantage for Volvo of using digital humans before instrumented physical models and [1] for each explanation up to [3 max].</i>	3
2.	a		orthographic projection/orthographic drawing/third angle orthographic; provides (2D) views/angles/sides with measurements/dimensions;	<i>Award [1] for each part of a description of the graphical model up to [2 max].</i>  <i>Accept 'orthogonal'</i>  <i>Do not award a second mark without a reference to measurements/dimensions</i>	2
2.	b		aluminium does not rust/corrode/oxidise (like steel); steel trays would not last as long as aluminium/are less sanitary (for animals);  aluminium is a lightweight material; making it easier to move/transport/install;  aluminium is more malleable (than steel) making it easier to shape/bend/fold;	<i>Award [1] for identifying why Hydroponics Africa used aluminium, rather than steel, for the animal feed trays and [1] for a development of that reason up to [2 max].</i>  <i>Do not award marks between clusters.</i>	2

Question			Answers	Notes	Total
3.			<p>end of pipe technology is used to reduce pollutants/waste at the end of a process; different types of pollutants can be released during the manufacturing process; that may not be addressed with one single solution/system;</p> <p>end of pipe technology is used to reduce pollutants/waste at the end of a process; end of pipe approach is reactive (not proactive); it can be expensive/only serves to contain a problem that has already occurred;</p>	<p><i>Award [1] for identifying why end of pipe technology is considered to be the least effective way of cleaning up production and [1] for each explanation up to [3 max].</i></p> <p><i>Do not award marks between clusters.</i></p>	3
4.			<p>comfort is a person's sense of (physical or psychological) ease; fatigue is a person's sense of (physical or psychological) tiredness; comfort is measured in a given moment while fatigue is measured over time;</p> <p>comfort is a person's sense of (physical or psychological) ease; fatigue is a person's sense of (physical or psychological) tiredness; comfort has a positive impact while fatigue has a negative impact;</p>	<p><i>Award [1] for each distinct point in an explanation of the difference between comfort and fatigue and [1] for each explanation up to [3 max].</i></p> <p><i>Do not award marks between clusters.</i></p>	3

## Section B

Question			Answers	Notes	Total
5.	a		the target audience for Brave Dave™ are parents of (young) children; as it is the parents who have the marketing aimed towards them/purchase the product;	<i>Award [1] for identifying the target audience for Brave Dave™ and [1] for a brief explanation up to [2 max].</i>	2
5.	b		constructive discontent; to improve a product when a problem is identified/based on dissatisfaction; the designer was concerned about toxins/environmental impact of materials in existing products;  desire to help others; by designing a product to improve health/wellbeing of children; by making it safe/fun/engaging;	<i>Award [1] for identifying the driver for invention for Brave Dave™ and [1] for each explanation up to [3 max].</i>  <i>Do not award marks between clusters.</i>	3
5.	c		<b>High compressive strength</b> compressive strength is the ability of a material to withstand being pushed/squashed; the shapes/folds/internal pieces of the wool are designed to withstand compression/force; preventing Brave Dave™ from being damaged by users/allowing greater durability;  <b>Low mass</b> mass is the amount of matter that is contained within a material; low mass results in a lighter material/product; making Brave Dave™ easier to be handled/played with by the user;	<i>Award [1] for identifying why high compressive strength is an important property for the wool used for Brave Dave™ and [1] for each explanation up to [3 max].</i>  <i>Award [1] for identifying why low mass is an important property for the wool used for Brave Dave™ and [1] for each explanation up to [3 max].</i>  <i>Mark as [3] + [3].</i>	6

Question 5 continued



Question			Answers	Notes	Total
5.	d		<p><b>Production</b>  Brave Dave™ uses a click and lock assembly system;  meaning that there is no joining/assembling required;  lowering the total amount of energy utilised in the production stage;</p> <p><b>Distribution</b>  Brave Dave™ is flat packed;  which enables more products to be shipped per container/helps to maximise transportation space;  reducing CO2 emissions/fuel/gas;</p> <p><b>Disposal</b>  Brave Dave™ is made from natural/renewable materials (wool/pine);  meaning the product is biodegradable;  and will break down quickly when disposed;</p>	<p><i>Award [1] for each distinct point in an explanation how the designers of Brave Dave™ have minimised the impact on the environment during the LCA stage of production up to [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation how the designers of Brave Dave™ have minimised the impact on the environment during the LCA stage of distribution up to [3 max].</i></p> <p><i>Award [1] for each distinct point in an explanation how the designers of Brave Dave™ have minimised the impact on the environment during the LCA stage of disposal up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9

Question			Answers	Notes	Total
6.	a		50 <sup>th</sup> percentile (of adult population); which fits the majority of users/one size designed to fit all;	<i>Award [1] for identifying the percentile that the Streetdog is designed for and [1] for a brief explanation up to [2 max].</i>	2
6.	b		provides highly realistic images; as rendering can be presented early in the ideation stage; enabling user/client feedback;  reduces the need for a physical model; CAD is quicker; feedback can be received earlier/at a lower cost;	<i>Award [1] for identifying why the CAD rendering was used in the development of the Streetdog and [1] for each explanation up to [3 max].</i>  <i>Do not award marks between clusters</i>	3
6.	c		<b>Psychological function</b> psychological function is an emotional response to the design; the minimalist style/retro design of the Streetdog has a nostalgic appeal; which appeals to traditional motorbike fans/a younger market;  <b>Practical function</b> practical function is a logical or well-reasoned approach to design/concerns the performance of a product; the Streetdog is rechargeable/easy to manoeuvre/smooth; which appeals to motorcyclists who ride in urban/city environments;	<i>Award [1] for identifying how the Streetdog appeals to buyers considering psychological function and [1] for each explanation up to [3 max].</i>  <i>Award [1] for identifying how the Streetdog appeals to buyers considering practical function and [1] for each explanation up to [3 max].</i>  <i>Mark as [3] + [3].</i>	6

Question 6 continued

Question			Answers	Notes	Total
6.	d		<p><b>One-off production</b> a one-off production is a prototype for larger scale production; used at the end of the design development stage; to provide a sample to show to investors/buyers/for marketing/to test the design;</p> <p><b>Batch production</b> batch production is limited volume production/a set number of items to be produced; as quantities are known in advance; the production process can be set up/optimised for the number required;</p> <p><b>Mass customisation</b> mass customisation is a system that manufactures products to individual orders; customers can upload their own graphics that can be applied to their bikes (in the factory); offering mass customisation makes the FTN Motion more appealing to buyers/requires lower setup costs/less labour to manufacture/benefits economies of scale;</p>	<p><i>Award [1] for identifying how FTN Motion may utilise one-off production in the development and production of the Streetdog and [1] for each explanation up to [3 max].</i></p> <p><i>Award [1] for identifying how FTN Motion may utilise batch production in the development and production of the Streetdog and [1] for each explanation up to [3 max].</i></p> <p><i>Award [1] for identifying how FTN Motion may utilise mass customisation in the development and production of the Streetdog and [1] for each explanation up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9

Question			Answers	Notes	Total
7.	a		<p>cutting; (the outline of the desk and slots for assembly would be) cut using a blade/laser/die/stamp to subtract the material;</p> <p>die cutting; (the outline of the desk and slots for assembly would be) pressed and cut out by a machine using a metal die;</p> <p>laser cutting; (the outline of the desk and slots for assembly would be) cut using a high-powered laser;</p>	<p><i>Award [1] for identifying each part of a description of the subtractive technique used to shape the cardboard in the Refold Standing Desk and [1] for a brief explanation up to [2 max].</i></p> <p><i>Do not award marks between clusters.</i></p>	2
7.	b		<p>clearance is the physical space between two objects; the Refold desk provides clearance for the legs and feet; this allows the user to stand at the desk comfortably/without affecting posture/causing fatigue;</p>	<p><i>Award [1] for identifying how the Refold Standing Desk addresses clearance and [1] for each explanation up to [3 max].</i></p>	3
7.	c		<p><b>Scale model</b> a scale model of the desk can be a larger/smaller version of the design; used to visualise the form/aesthetics/proportions (with an ergonome/mannequin); and gather feedback from the design team/client;</p> <p><b>Mock-up</b> a mock-up of the desk can be used to test ideas; such as the folds/weight/size/positioning of the slots/tolerances of the slots; to ensure the desk is stable/easy to assemble/easy to transport;</p>	<p><i>Award [1] for identifying how scale models would have been used in the development of the Refold Standing Desk and [1] for each explanation up to [3 max].</i></p> <p><i>Award [1] for identifying how mock-ups would have been used in the development of the Refold Standing Desk and [1] for each explanation up to [3 max].</i></p> <p><i>Mark as [3] + [3].</i></p>	6

Question 7 continued

Question			Answers	Notes	Total
7.	d		<p><b>Inventor</b>  an inventor is an individual who is committed to the invention of a (novel) product/principle/technical advance;  based on constructive discontent/dissatisfaction of other products;  resulting in a cardboard desk that is simple/recyclable/easy to carry/assemble/disassemble;</p> <p><b>Product Champion</b>  a product champion develops enthusiasm for a particular idea or invention/champions an idea within the organisation;  Refold developed a clear philosophy that they used to champion the product/brand;  which went viral/gained global recognition;</p> <p><b>Entrepreneur</b>  an entrepreneur is an influential individual who can take an invention to market;  Refold set up a successful Kickstarter campaign to provide the funding/finance (for their first production run);  which decreased the financial risk (for the company);</p>	<p><i>Award [1] for identifying how Refold are inventors and [1] for each explanation up to [3 max].</i></p> <p><i>Award [1] for identifying how Refold are product champions and [1] for each explanation up to [3 max].</i></p> <p><i>Award [1] for identifying how Refold are entrepreneurs and [1] for each explanation up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9