

Markscheme

May 2024

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 force for acceleration.</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 required 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	50th (percentile of adult population);	<i>Award [1] for stating the percentile that would be used to determine the height of the handle of the Husqvarna lawnmower.</i>	1
1.	a	ii	Practical function relates to the performance and function of a product; The lawnmower is quiet/easy to maintain/repair;	<i>Award [1] for identifying a reason why practical function is influential in the design of the Husqvarna lawnmower up to [2 max].</i>	2
1.	b	i	Low weight/light weight; Reduces fatigue for the user; Toughness; Unlikely to crack during use; Durability; Resistant to corrosion /doesn't rust/ suitable to work outdoors/increased longevity;	<i>Award [1] for identifying a property of aluminium that makes it suitable for the cutting deck and [1] for a development up to [2 max]. Do not award marks across clusters.</i>	2
1.	b	ii	Finite Element Analysis/FEA; The calculation and simulation of unknown factors in products using CAD systems; Allows simulation (stress analysis) of forces from different objects/ground surfaces;	<i>Award [1] for each relevant point in the description of the type of Computer Aided Design (CAD) modelling used to test the forces acting on the aluminium cutting deck up to [2 max].</i>	2

Question 1 continued

Question			Answers	Notes	Total
1.	c	i	The basic configuration stays the same/one or more key components are changed; The lawnmower uses a (rechargeable) battery instead of fossil fuels;	<i>Award [1] for how modular innovation is used as the design innovation strategy for the Husqvarna lawnmower and [1] for a development up to [2 max].</i>	2
1.	c	ii	Relative advantage is how improved a product is over the previous generation; The Husqvarna lawnmower doesn't burn fossil fuels/pollutes less/is quieter/has reduced maintenance/is easy to recharge; Adopted by consumers/increased sales/ facilitates acceptance into the market;	<i>Award [1] for each distinct point in an explanation of the Relative Advantage of the Husqvarna lawnmower over fossil fuel powered lawnmowers up to [3 max].</i>	3
1.	d	i	Thermosetting (plastic); (Polyurethane (PUR), Urea formaldehyde).	<i>Award [1] for stating the type of plastic used for the battery case up to [1 max].</i>	1
1.	d	ii	Molten plastic is injected (pushed) into a mould cavity; The plastic solidifies in the mould once it cools;	<i>Award [1] for each relevant point in the description of how the plastic is injection moulded up to [2 max].</i>	2

Question 1 continued

Question			Answers	Notes	Total
1.	e	i	<p>Can be recycled;</p> <p>Rechargeable;</p> <p>Fast charging;</p> <p>Light weight;</p> <p>Consistent temperature range;</p> <p>Constant power;</p> <p>Maintenance free;</p> <p>Temperature tolerant;</p> <p>less hazardous/toxic (than other batteries);</p> <p>Long shelf life;</p> <p>High capacity;</p>	<p><i>Award [1] for listing each advantage of lithium-ion batteries up to [2 max].</i></p>	2
1.	e	ii	<p>Utilization is a stage of the product life cycle where the product is used;</p> <p>The batteries are rechargeable / do not create air pollution;</p> <p>Burning fossil fuels leads to air pollution;</p> <p>Utilization is a stage of the product life cycle where the product is used;</p> <p>The battery powered lawnmower runs quietly / creates low levels of noise pollution;</p> <p>Fossil fuel powered lawnmowers produce noise pollution;</p>	<p><i>Award [1] for each of three distinct points in an explanation of how the Husqvarna lawnmower minimises pollution in utilization compared to lawnmowers that use fossil fuels to [3 max].</i></p> <p><i>Do not award marks across clusters.</i></p>	3

Question		Answers	Notes	Total
2.	a	Ordinal; An arbitrary numerical scale where the exact numerical value has no significance; Ratio scale; The scale starts at zero and increases in increments;	<i>Award [1] for identifying the type of scale used for the volume dial on the Marshall speaker and [1] for a development up to [2 max].</i>	2
2.	b	Retro-styling; A design that uses the form and decoration from a particular period of time and/or style;	<i>Award [1] for identifying the classic design strategy used for the Marshall Speaker and [1] for a development up to [2 max].</i>	2
3.		An idea from one context is used to stimulate ideas for solving a problem in another context; The patterns from nature were used to develop the textures on the Puzzler; This produced an unexpected/original/organic pattern that would have been otherwise difficult to develop;	<i>Award [1] for each of three distinct points in an explanation of why Analogy was used in the development of the Puzzler up to [3 max].</i>	3
4.		A technique that places melted layers of material on a bed to build up a 3D model; A type of rapid prototyping that is comparatively quick/low cost/easily accessible;	<i>Award [1] for each of three distinct points in an explanation of why designers would use FDM for prototyping up to [3 max].</i>	3

Section B

Question		Answers	Notes	Total
5.	a	Circular economy; Waste is used as a resource (within a closed-loop system);	<i>Award [1] for identifying the waste mitigation strategy used by the can rings and [1] for a development up to [2 max].</i>	2
5.	b	The barley and wheat material is placed into an open, (heated) mould cavity; The mould is then closed and compressed; The material cures in the heated mould;	<i>Award [1] for each of three distinct points in an explanation of how the can rings would be compression moulded up to [3 max].</i>	3
5.	c	Incremental solutions: Products which are improved and developed over time (leading to new versions and generations); The rings work in a similar fashion to previous versions/are compatible with existing cans; which would make the implementation of the design easier to adopt by consumers; Radical solutions: Where a completely new product is devised (by going back to the roots of a problem and thinking about a solution in a different way); the development of the new material would take long/be expensive/but if successful would bring big benefits to the company; They are expensive to implement because they require a whole system change/the benefits could be significant but the risks are also high;	<i>Award [1] for each of three distinct points in an explanation of why manufacturers would consider incremental solutions for green design up to [3 max].</i> <i>Award [1] for each of three distinct points in an explanation of why manufacturers would consider radical solutions for green design up to [3 max].</i> <i>Mark as [3] + [3].</i>	6

Question 5 continued

Question		Answers	Notes	Total
5.	d	<p>Tensile strength: The ability of a material to withstand pulling forces; The weight/mass of the cans will be pulling on the composite; The barley and wheat composite needs to withstand this force or it will stretch and deform;</p> <p>Elasticity: The extent to which a material will return to its original shape after being deformed; The barley and wheat composite needs to be elastic enough that the holes in the ring return to their original shape once the can is inserted; Otherwise the cans will not be secured / will fall out;</p> <p>Plasticity: The ability of a material to be changed in shape permanently; Plasticity would be required for the production of the rings; To allow for deformation into the required shape;</p>	<p><i>Award [1] for each of three distinct points in an explanation of how the barley and wheat composite addresses tensile strength up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points in an explanation of how the barley and wheat composite addresses elasticity up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points in an explanation of how the barley and wheat composite addresses plasticity up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9

Question		Answers	Notes	Total
6.	a	Desire to help others; The Mia chair is designed to help children with autism;	<i>Award [1] for identifying the driver for invention for the Mia Hoodie Chair and [1] for a development up to [2 max].</i>	2
6.	b	Timber is cut into thin strips/ply and glued together; Then clamped in a mould/jig/form; Once released (from the clamps), the laminated timber retains the shape (of the mould/jig/form);	<i>Award [1] for each of three distinct points in an explanation of the process of lamination up to [3 max].</i>	3
6.	c	Texture: The chair has a soft fabric; Appeals to the sensory needs of children living with Autism; Which is calming/soothing for the user; Light: The hoodie can be pulled over your head/body to block out any light; Creating a dark/opaque environment; Which would help the children control visual stimulation;	<i>Award [1] for each of three distinct points in an explanation of how the Mia Hoodie Chair satisfies the psychological factor of texture up to [3 max].</i> <i>Award [1] for each of three distinct points in an explanation of how the Mia Hoodie Chair satisfies the psychological factor of light up to [3 max].</i> <i>Mark as [3] + [3].</i>	6

Question 6 continued

Question		Answers	Notes	Total
6.	d	<p>Sketches: Rough drawings of ideas used to convey or refine the idea; They are quick and easy to produce; Can be used to communicate multiple ideas/iterations;</p> <p>Mock ups: A scale or full-size representation of a product used to gain feedback from users; A mock-up is used to test ideas without making a full prototype; The idea of the hoodie could have been tested without having to make a chair base / An existing chair base could have been modified to hold the hoodie / Individual design details (such as how the materials are connected) could have been tested;</p> <p>Surface model: A realistic picture of the final model/ with no data about the interior of the part; This gives an accurate visual/geometrically correct representation of what the final product will look like; Useful for getting feedback about colour/texture/shapes/complex forms/proportions / can be used for promotional purposes/to attract investors;</p>	<p><i>Award [1] for each of three distinct points of how sketches would have been used in the development of the Mia Hoodie Chair up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points of how mock ups would have been used in the development of the Mia Hoodie Chair up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points of how surface modelling would have been used in the development of the Mia Hoodie Chair up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9

Question		Answers	Notes	Total
7.	a	Stainless-steel is corrosion resistant/has high hardness; If the clipper corrodes/is damaged, its sharpness/hygiene/ability to be sterilised/aesthetics (physical or mechanical properties) will be affected;	<i>Award [1] for identifying why stainless-steel was used for the Klhip clipper and [1] for a development up to [2 max].</i>	2
7.	b	Casting involves heating the stainless-steel material above its melting point; Then pouring the molten material into a mould; Where it solidifies into the required shape;	<i>Award [1] for each of three distinct points in an explanation of the process of casting up to [3 max].</i>	3
7.	c	Static data: Human body measurements when the subject is still; Klhip would use data for the width/curvature/shape of finger nails; the blades of the clipper need to work for the nails they are cutting; Dynamic Data: Human body measurements taken when the subject is in motion related to range and reach of various body movements; Klhip would use data on forces/measurements for the opening and closing of thumb and fore finger; The user needs to grip and squeeze the clipper to operate it;	<i>Award [1] for each of three distinct points in an explanation of how static ergonomic data would have been used in the development of the Klhip clipper up to [3 max].</i> <i>Award [1] for each of three distinct points in an explanation of how dynamic ergonomic data would have been used in the development of the Klhip clipper up to [3 max].</i> <i>Mark as [3] + [3].</i>	6

continued

Question		Answers	Notes	Total
7.	d	<p>Patent: An agreement from a government office to give someone the right to make or sell a new invention (for a certain number of years); Klhip would have to register its design legally in the markets they sell in; This would prevent design features/the reverse lever/the mechanism from being copied;</p> <p>Copyright: A legal right that grants the creator of an original work exclusive ownership for its use and distribution; Copyright is (automatically) applied to works of creativity (such as the promotional and marketing material website/original freehand sketches); Copyright will prevent others from copying the creative works (Copyright can be used to receive compensation/royalties from the sales/use of creative works;</p> <p>Trademark: A trademark is a symbol, word, or words legally registered to a company (or product); Klhip would trademark their brand name/logo (as seen in the image) to protect the name/font/colours used; This means their brand will remain recognisable/differentiated from other brands ;</p>	<p><i>Award [1] for each of three distinct points of how Klhip would use patents, to protect its intellectual property up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points of how Klhip would use copyright to protect its intellectual property up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points of how Klhip would use trademarks to protect its intellectual property up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9