Markscheme

November 2025

Design technology

Higher level and standard level

Paper 2

14 pages

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* ***force*** *for* ***acceleration****.*	**2**

1. Each row in the "Question" column relates to the smallest subpart of the question.

2. The maximum mark for each question subpart is indicated in the "Total" column.

3. Each marking point in the "Answers" column is shown by means of a semi colon at the end of the marking point.

4. 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.

5. An alternative wording is indicated in the "Answers" column by a slash (*/*). Either wording can be accepted.

6. An alternative answer is indicated in the "Answers" column by "***OR***" on the line between the alternatives. Either answer can be accepted.

7. Words in angled brackets ❮ ❯ in the "Answers" column are not necessary to gain the mark.

8. Words that are <u>underlined</u> are required for the mark.

9. The order of marking points does not have to be as in the "Answers" column, unless stated otherwise in the "Notes" column.

10. 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).

11. 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	Test and evaluate the design; Tangible model/visualise the design; Gain feedback from potential users/manufacturers/designers; Selection of appropriate materials and textures;	*Award **[1]** for stating the benefit of the use of physical models for designers.*	**1 max**
1.	a	ii	The ability to preview/present prototype virtually; Share designs across the world; Speed up the development process; Easy to modify size and scale; Precision and accuracy; facilitates FEA/Data analysis; Rapid prototyping/3D printing for testing/iterative design; Less materials Cost effective/lower cost; Enhancing the whole design cycle by using data analysis from conception to final manufacture;	*Award **[1]** for each advantage of Meccano® designers using Computer Aided Design (CAD) models over physical models up to **[2 max]**.*	**2 max**
1.	b	i	Reuse; waste mitigation; Users never get tired/ remain engaged; Prolongs the product life; more efficient use of resources;	*Award **[1]** for identifying how the ability to create endless constructions using the Meccano® parts reduces waste/pollution **[2 max]**.*	**2 max**
1.	b	ii	biomechanics connections to the design of different products considering muscle; grip and strength/age/ and torque; anthropometrics; motor skills; physiological factors; Texture;	*Award **[1]** for stating which aspect of human factor design, is considered when using a screwdriver to fix one Meccano® plate to another reason up to **[2 max]**.*	**2 max**

Question 1 continued

Question			Answers	Notes	Total
1.	**c**	**i**	Inventions may become costly to produce for public consumption; Inventions may take a long time to become innovations and the need/demand for the product may disappear; marketability difficult to market; Insufficient technological capability to create the product;	*Award **[1]** each reason why only a small number of inventions become innovations **[2 max]**.*	**2 max**
1.	**c**	**ii**	Taking on both these roles requires: 1) **Invento**r needs to take on two roles, therefore double the work **/**financial limitations ; 2) **Product champion** a significant amount of learning required to take an idea from the mind, realize it and then diffuse it /complexity of the task; 3) **Entrepreneur** it is difficult to place a design idea successfully in the marketplace /risk taking/Inventor design bias can lead to rejecting necessary business adaptations**;**	*Award **[1]** one disadvantage of Frank Hornby taking the roles of:* ***product champion, inventor** & **entrepreneur [3 max]**.*	**3 max**
1.	**d**	**i**	Classic Design - A product that serves as a standard of its time, that has been manufactured industrially and has timeless appeal and transcends design obsolescence;	*Award **[1]** for an accurate definition of the term classic design **[1 max]**.*	**1 max**
1.	**d**	**ii**	New developments in engineering, electronic and Scientific research leads to advances in technology that underpin new ideas; Designers wanted to develop the electronic additions to meet the needs of new consumers and keep up with the new technology; Education benefits of the electronics;	*Award **[1] for the correct reason** technology push may have aided Meccano product development via the inclusion of electronic additions to the kits **[2 max]**.*	**2 max**

Question 1 continued

Question			Answers	Notes	Total
1.	e	i	The calculation and simulation of unknown factors in products using CAD systems; calculate the stresses on the parts/Identify weak points/Choose appropriate; materials/Use the data to improve the design/ **test and choose appropriate joints**;	*Award **[1]** for advantage why Finite Element Analysis (FEA) would have been used in the design of the modern versions of Meccano® **[2 max]**.*	**2 max**
1.	e	ii	Hardness is a materials ability to resist cutting/scratching/dents/penetration; Alloying enhances an aesthetics and durability through its protective surface; Alloying enhances mechanical properties increasing rigidity deformation, longevity/ durability and preserves the appearance of the product; Alloy is a mixture that contains at least one metal; The added atoms distort the crystal lattice; This increases resistance to dislocation/deformation resulting in improved hardness;	*Award **[1]** for how each distinct point in an explanation why the hardness of the Meccano® metal strips are improved by 'alloying' up to **[3 max]**.* *Do no award marks across clusters*	**3 max**

Question			Answers	Notes	Total
2.	a		Less costs and materials used to produce many wheelchairs; The user can easily adjust different parts of the wheelchair to suit their needs; Better reach and comfort when using the wheelchair; Enhancing safety; usability	*Award **[1]** for stating each advantage of adjustability over a range of sizes in the design of wheelchairs **[2 max]**.*	**2 max**
2.	b		Comfort (A person's sense of physical or psychological ease); Considered in the design/size/shape of the seat/backrest/footrest; Biomechanics in Human factors include the research and analysis of the mechanics (movement of our muscles, joints, tendons, etc.) of our human body; Force (impact on user's joints), Repetition, Duration and Posture; Physiological data- Human factor data related to physical characteristics used to optimise the user's safety/ health/ comfort and performance; Anthropometrics specific to people with ability needs (The aspect of ergonomics that deals with body measurements/ particularly those of size/ strength/ physical capacity;	*Award **[1]** for identifying each point on how an understanding of the 'human factors' informed the development of the self-driving wheelchairs. **[2 max]**.*	**2 max**

Question			Answers	Notes	Total
3.			Design for disassembly Designing a product so that when it becomes obsolete it can easily and economically be taken apart; Components reconditioned/ reused/repaired/materials recycled; To reduce waste/environmental impact; easily portable;	*Award **[1]** for defining the term design for disassembly and one for each point identifying why the Little Sun Solar Lamp was designed for disassembly **[3 max]**.*	**3**

Question			Answers	Notes	Total
4.			Costs; More material is used in subtractive manufacture; Subtractive techniques can mean a wider variety of costly raw materials are used; subtractive is more expensive than additive printing techniques; Waste; additive printing is less waste; the material breaks down in compost; no complex recycling processes for users; Mass customisation additive printing can be customised/colour/texture/pattern; Users can make specific changes to customise a trainer; A more efficient way to manufacture trainers;	*Award **[1]** for identifying advantage of using an additive rather than a subtractive manufacturing technique. **[3 max]**.*	**3 max**

Section B

Question			Answers	Notes	Total
5.	**a**		Personal interviews about ease of using the radio; direct observation/comfort/performance test/user trial;	*Award **[1]** for identifying* how physiological data that may have been collected during the design of the Vitra 21st century digital version of the Eames Radio. ***[2 max]***.	**2 max**
5.	**b**		exposed components; simple; rectilinear form; Scale/size;	*Award **[1]** for explaining award[1] for stating how each design feature contributes to the overall aesthetic **[3 max]**.*	**3 max**
5.	**c**		Advantage Modular innovation for user 1) Changeable selections of components for the products/ customizability; 2) trends / simpler, /faster/ easy to use; 3) Greater user interaction/ user led; Disadvantage Modular innovation for user 1) Longer development time; 2) Front loaded design manufacture; 3) Costs of final unit may be higher;	*Award [1] for each* **advantage** of using modular innovation for user ***[3 max]***. *Award **[1]** for each* **disadvantage** of using modular innovation for user ***[3 max]***. *Mark as **[3]** + **[3]**.*	**6 max**

Question 5 continued

Question			Answers	Notes	Total
5.	**d**		Materials are high quality/timeless; Will remain in fashion for a long time; Will not be replaced by newer version; Materials are high quality/durable; Will resist scratches and cracks, dents; The product will not break easily, or be replaced/fewer raw materials / dematerialization; Pollution Small amounts of materials used mean less resources required to make the product; Resulting in less deforestation/ore/extraction; Better quality/durability means the materials/product last longer and can be handed down to next generation of users without buying a new product; Energy Conserved energy by manufacturing fewer radios; The new version of the radio is designed for changes in energy outputs; The new version of the radio is designed for multi country energy sources;	*Award **[1]** for explaining* how the Eames Radio has considered **materials**, in the design of the radio ***3 max]***. *Award **[1]** for explaining how pollution was considered in the design of the radio, **[3 max]**.* *Award **[1]** for explaining how* **energy was considered in the design of the radio *[3 max]***. *Mark as **[3]** + **[3]** + **[3]**.*	**9 max**

Question			Answers	Notes	Total
6.	a		An additive manufacturing technique that uses laser to fuse small particles of materials/powder; Used for short runs/minimal support required/accurate/used for bespoke products; Trialiability;	*Award **[1]** for identifying why* SLS was used for the Bond Touch bracelet. ***[2 max]***.	**2 max**
6.	b		The reduction of total material and energy throughput of any product and service; Less raw material is required to be extracted/less energy required in the production; Less waste produced/emissions/pollution in manufacture; strategy for the disposal/end of life of the product;	*Award **[1]** for explaining why dematerialisation was an important consideration of the design of the Bond Touch bracelet **[3 max]**.*	**3 max**
6.	c		personal motivations to express creativity; personal interest; Scientific or technical curiosity; Constructive discontent; Desire to help others; Desire to make money;	*Award **[1]** for each of the* drivers for invention for Bond Touch *Mark as **[3]** + **[3]**.*	**6 max**

Question 6 continued

Question			Answers	Notes	Total
6.	d		**Patents** making a patent public means showing all the technical information – open to others copying; To be first to market; Applying for patent can be complex and time consuming and expensive for sole-traders; Annual fees attached the patent for the life of the product; Defending a patent is costly and complicated, may need legal representation; A patent doesn't always cover every aspect of the product and there may be openings for others to use; Patents are territorial, other people in other countries could steal the design; designers may choose to keep the design open and free of legal restrictions to make it more accessible and beneficial to others; **Copyrights** Difficulty of proof: Proving ownership and infringement can be challenging without proper documentation; Rapid iteration: In fast-paced design industries, protecting every design might hinder the ability to quickly adapt and innovate; Overconfidence: Designers may believe their work is unique enough to avoid infringement without formal protection; **Trademarks** Trademark registration can be expensive, involving application fees, attorney costs, and potential renewal fees; Designers often prioritize creating new work over administrative tasks like trademark registration; Some designers may not fully understand the importance of intellectual property protection and the benefits of trademarks;	*Award **[1]** stating why some designers do <u>not</u> protect their intellectual property with **patents** up to **[3 max]**.* *Award **[1]** stating why some designers do <u>not</u> protect their intellectual property trademarks up to **[3 max]**.* *Award **[1]** stating why some designers do <u>not</u> protect their intellectual property copyright up to **[3 max]**.* *Mark as **[3]** + **[3]** + **[3]**.*	**9**

Question			Answers	Notes	Total
7.	**a**		Composite materials are materials composed of two or more different materials that have been combined to create one new material; Advantage over singular materials is that composite materials add greater improved properties than the individual materials alone;	*Award **[1]** for defining the term composite materials and award [1] **one** advantage of using composite materials **[2 max]**.*	**2 max**
7.	**b**		Renewable is classed as a natural resource that can replenished; Renewable with the passage of time/does not abate at all; Mycelium is classed as a renewable resource as it contains composite elements that can be easily renewed within a passage of time;	*Award **[1]** for identifying the …. definition of renewable and **[1]** whether Mycelium is a renewable or non-renewable resource **[3 max]**.*	**3 max**
7.	**c**		**Reduced Material Usage:** BIOPODs use significantly less material than traditional plant pots, especially those made from plastic or ceramic. They are designed to be lightweight and minimal, using only the necessary material to hold the soil and seedling. This directly reduces the consumption of raw materials, contributing to dematerialization; **Biodegradable:** By being biodegradable, BIOPODs avoid the need for disposal of a separate container. Traditional pots often end up in landfills, contributing to waste. BIOPODs, on the other hand, break down naturally, returning their materials to the earth and minimizing their environmental footprint. This aligns with the principles of dematerialization by reducing the long-term material impact of the product;	*Award **[1]** for identifying the definition of dematerialization **[1]** for each subsequent dematerialization strategies **[3 max]**.* *Mark as **[3]** + **[3]**.*	**6 max**

Question 7 continued

Question			Answers	Notes	Total
7.	**d**		**Photochromicity (definition)** A photochromic material changes colour in response to an increase in light. When the light source is removed, it returns to its original colour; **Positives** Increases colour in changing light; Increases visual aspects without using dyes which could leak into water system; Cost effective; Changes colour when in different locations; **Negatives** Takes a long time to change colour/the change is not instant; Not able to change colour in poor light/not able to change colour in darkness; Limited colour range; Not sure how the smart material will affect the 'mycelium' therefore extra testing required -this could result in extra costs;	*Award **[1]** for defining photochromicity* *Award **[1]** for explaining the positives* considerations to use Photochromic smart material. *up to **[4 max]**.* *Award **[1]** for explaining the negatives* considerations to use Photochromic smart material. **[4]**	**9**