8823–6203M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2023

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 essential 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	hand/palm size; finger/thumb size/length/width;	*Award **[1]** for stating one* piece of anthropometric data required in the design of the Nokia 3310.	1
1.	a	ii	mass production; millions of units made/sold; culture; iconic/internet memes in sub-culture/youth culture; image; the shape is instantly recognisable/nostalgic; transcends obsolescence; functions as well as it did when first manufactured; dominant design; product/s process that leads a product category ubiquitous; can be seen almost everywhere;	*Award **[1]** for one characteristic of the Original Nokia 3310 in Figure.1 that makes it a classic design and **[1]** for a brief explanation up to **[2 max]**.* *Do not award marks across clusters*	2
1.	b	i	the rounded form of the updated Nokia; respects/imitates the shape/features of the original phone; the layout/shape/size of the buttons/screen of the updated Nokia; respects/imitates the layout of the original phone;	*Award **[1]** each part of a description of how retro styling was used in the design of the updated Nokia 3310 in Figure 2 up to **[2 max]**.* *Do not award marks across clusters*	2
1.	b	ii	(environmental) legislation; consumer pressure;	*Award **[1]** for listing each driver for mobile phone manufacturers to implement green design up to **[2 max]**.*	2

Question			Answers	Notes	Total
1.	c	i	design for disassembly allows parts to be (taken apart to be) replaced/repaired/reconditioned; such as worn-out batteries, broken screen or range of aesthetic covers.	*Award **[1]** for identifying how design for disassembly extended the lifespan of Nokia phones and **[1]** for a brief explanation up to **[2 max]**.* *Do not award marks across clusters*	**2**
1.	c	ii	FEA is the calculation and simulation of unknown factors in products using CAD systems/the manufacturer can test the impact of a force on the phone; produces (colour coded) results to highlight areas of stress; allowing the designer to modify the structure/materials ensuring the product can resist impacts/stresses;	*Award **[1]** for identifying* how Finite Element Analysis (FEA) can help mobile phone manufacturers develop durable products *and **[1]** for each distinct explanation up to **[3 max]**.*	**3**
1.	d	i	late Majority;	*Award **[1]** for stating the category of consumer that adopted the original Nokia 3310 in 2000.*	**1**
1.	d	ii	2+2+1+6 or 7; 11 or 12;	*Award **[2]** for calculating the total number of survey respondents who adopted a mobile phone between 1982 and 1990.*	**2**
1.	e	i	the last to adopt an innovation; tend to prefer traditions; are unwilling to take risks;	*Award **[1]** for listing each characteristic of a laggard up to **[2 max]**.*	**2**
1.	e	ii	a sustaining innovation is a new or improved product; relying on incremental improvements (to mobile phones/product versioning); to sustain manufacturers/meet the needs of the users/ market share/keep profits high;	*Award **[1]** for a distinct point how sustaining innovation applies to the design of mobile phones and **[1]** for each distinct explanation up to **[3 max]**.*	**3**

Question			Answers	Notes	Total
2.	**a**		FDM is an additive manufacturing technique that builds a model layer by layer; The layers are fused together as they are deposited; FDM is a rapid prototyping/3D printing technique that places melted layers of material on a bed/; to build up a 3D model;	*Award **[1]** for each appropriate comment in the description of Fused Deposition Modelling up to **[2 max]**.* *Marks may be awarded across clusters*	**2**
2.	**b**		shape-memory (materials that when deformed, spring back to their original shape when released); piezoelectric (a material that gives off a small electrical discharge when deformed);	*Award **[1]** for listing each type or property of smart materials that would be appropriate in 4D printing up to **[2 max]**.*	**2**
3.			scientific research leads to advances in technology that underpin new ideas; resulting from R+D/experimentation with (new) materials and technologies; That enables companies to offer new products (without a clear market need);	*Award **[1]** for each distinct point in an explanation of why many new innovations result from technology push up to **[3 max]**.*	**3**
4.			converging technologies merge a number of different technologies into one product; there is less need to produce a number of different products to fulfil different purposes/needs; this leads to a reduction in total resources required in manufacture/waste/ energy/pollution;	*Award **[1]** for each distinct point in an explanation of why converging technologies contribute to eco-design up to **[3 max]**.*	**3**

Section B

Question			Answers	Notes	Total
5.	**a**		a multidisciplinary approach draws from multiple areas of expertise; the project is a collaboration between space architecture specialists and robotic specialists/space construction projects are complex;	*Award **[1]** for identifying a* reason *why Project Olympus requires a multidisciplinary approach and **[1]** for a brief explanation up to **[2 max]**.*	**2**
5.	**b**		environmental factors can affect the performance of an individual situated in a given environment; controlling factors such as light/ventilation/oxygen levels/temperature; would maximise alertness/safety/efficiency/comfort.	*Award **[1]** for identifying a reason why the environmental factors of the interior of the Lunar Lantern need to be carefully controlled and **[1]** for each distinct explanation up to **[3 max]**.*	**3**

Question			Answers	Notes	Total
5.	c		**Third generation robots** third generation robots are autonomous robots/can operate largely without supervision from a human; they work faster/are more efficient/can operate 24/7; reducing safety risks for humans (in flight/controlling/supervising the robots); third generation robots are autonomous robots/can operate largely without supervision from a human; they communicate using M2M protocols/have their own control unit; allowing them to work together/in swarms/construct multiple structures simultaneously; **Multi-task robots** multi-task robots are a type of robot that can perform more than one task (in a manufacturing environment); reduces the number of robots that would need to be deployed; reducing fuel use/cost of the mission; multi-task robots are a type of robot that can perform more than one task (in a manufacturing environment); this makes them more flexible/can change (end of arm) tooling; one robot can carry out different (construction) tasks;	*Award **[1]** for each distinct point in an explanation advantage of using third generation robots for construction of the Lunar Lantern on the moon up to **[3 max]**.* *Award **[1]** for each distinct point in an explanation* advantage *of using multi-task robots for construction of the Lunar Lantern on the moon up to **[3 max]**.* *Do not award marks between clusters* *Mark as **[3]** + **[3]**.*	**6**

5.	**d**		**Virtual prototypes** photorealistic/CAD-based interactive models that use surface/solid modelling; that help the design team/client visualise the design; and how it might appear in context/on the moon's environment **Scale drawings** a scaled drawing that is either a smaller or larger scale than the original object; the scale drawing shows the sizes/dimensions/proportions of the building; to communicate technical details/constructional details/relationship between the parts of the building; **Digital Humans** are a computer simulation of a variety of mechanical/biological aspects of the human body; digital humans would be used to test clearance/reach/size of furniture/maintenance in the interior of the Lunar lantern (in relation to the human body); to ensure a comfortable/safe working/living environment;	*Award **[1]** for each distinct point in an explanation of how virtual prototypes would be used in the development of the Lunar Lantern up to **[3 max]**.* *Award **[1]** for each distinct point in an explanation of how scale drawings would be used in the development of the Lunar Lantern up to **[3 max]**.* *Award **[1]** for each distinct point in an explanation of how digital humans would be used in the development of the Lunar Lantern up to **[3 max]**.* *Mark as **[3]** + **[3]** + **[3]**.*	**9**

Question			Answers	Notes	Total
6.	a		glass fibres are placed in a mould (hand lay-up/spray lay-up); resin is added and cured to form the shape of the chair;	*Award **[1]** for an appropriate description of each step of the moulding process up to **[2 max]**.*	**2**
6.	b		this physical scale model is a smaller (or larger) physical copy of an object; created to gather feedback from the design team/client; to assist further development/improvements; this scale model is a smaller (or larger) physical copy of an object; that can help visualise the idea/concept; to help communicate the look/form/style of the chair;	*Award **[1]** for each distinct point in an explanation of why a physical scale model would be used in the development of the Roly Poly Chair up to **[3 max]**.* *Do not award marks between clusters*	**3**

6.	**c**		**Practical function** practical function concerns the performance of the chair/is determined by the rational/logical approach to the design; the chair is designed to accommodate a variety of sitting/lounging positions; for increased versatility/comfort for a range of users; practical function concerns the performance of the chair/is determined by the rational/logical approach to the design; the chair has wide legs/curved shape; creating a stable structure/does not fall over/safe for children; practical function concerns the performance of the chair/is determined by the rational/logical approach to the design; toughened/tempered glass is treated to increase strength; and will not shatter (into sharp fragments) which could cause injury to users; practical function concerns the performance of the chair/is determined by the rational/logical approach to the design; fibreglass is a lightweight material; that enables the chair to be easy moved/transported; **Psychological function** psychological function is determined by the emotional response to the design; the aesthetics of the chair are organic/playful/sculptural; which evokes imagery of pregnancy/motherhood/well-being;	*Award **[1]** for each distinct point in the explanation of why psychological function would be used in the development of the Roly Poly* chair *up to **[3 max].*** *Award **[1]** for each distinct point in the explanation of why the practical function would be used in the development of the Roly Poly chair up to **[3 max].*** *Do not award marks between clusters* *Mark as **[3]** + **[3]**.*	**6**

Question			Answers	Notes	Total
6.	d		**Mechanical properties** toughness; the ability of a material to resist the propagation of cracks/impact resistant; allows for safe use of the chair under a variety of circumstances; compressive strength; the ability of a material to resist being pushed/squashed; the structure/form/materials of the chair are designed to support the (weight of the) user; **Physical properties** hardness; will resist scratching; retains an attractive appearance for longer/easier to clean; (high) density; is the mass per unit volume of a material; makes the chair stable; **Aesthetic characteristics** transparency ; gives the chair an attractive appearance/can be coloured/refracts light; makes the chair unique/stand out from other chairs;	*Award **[1]** for each distinct point in an explanation of how the mechanical properties of toughened glass make it suitable for the Roly Poly chair up to **[3 max].*** *Award **[1]** for each distinct point in an explanation of how the physical properties of toughened glass make it suitable for the Roly Poly chair up to **[3 max].*** *Award **[1]** for each distinct point in an explanation of how the aesthetic characteristics of toughened glass make it suitable for the Roly Poly chair up to **[3 max].*** *Do not award marks between clusters* *Mark as **[3]** + **[3]** + **[3]**.*	**9**

Question			Answers	Notes	Total
7.	**a**	**i**	injection moulding;	*Award **[1]** for stating the process used to manufacture the screw cap of the Future Pump Bottle.*	**1**
7.	**a**	**ii**	blow moulding;	*Award **[1]** for stating the process used to manufacture the body of the Future Pump Bottle.*	**1**
7.	**b**		indicates that an application (for a patent) has been applied for but not yet processed; those copying the invention may be liable for damages (including back-dated royalties); once a patent is issued; patent pending helps to prevent others from imitating the design (before the patent is issued); as the patent application process can take a long time; and the product may be launched before the intellectual property is fully protected.	*Award **[1]** for each distinct point in an explanation of why the design of the Future Pump bottle is 'Patent Pending' up to **[3 max].*** *Do not award marks between clusters.*	**3**
7.	**c**		data collected on the pushing force of a user's hand; determines the pressure/force required to push the pump down (for the majority of users); to enable to the correct amount of liquid to be dispensed; data collected on the torque/grip strength of a user's fingers; to determine the force required to twist the screw cap (for the majority of users); to ensure ease of use (to release the screw cap);	*Award **[1]** for each distinct point in an explanation of how biomechanical data may have informed the design of the Future Pump bottle up to **[3 max]**.* *Mark as **[3]** + **[3]**.*	**6**

Question			Answers	Notes	Total
7.	d		**Pre-production** the bottle is manufactured from one material; fewer raw materials are required for new bottles; reducing energy in the extraction of (a wider variety of) materials/oil; **Production** manufacturing utilises a smaller number of machines/processes; which would reduce manufacturing time; reducing energy consumption of running multiple (types of) machinery/creates a more efficient workflow/system; **Disposal** the bottle is made from the same (type of) thermoplastic material; reducing the energy required to separate different materials; simplifying the recycling process/making the bottle 100% recyclable.	*Award **[1]** for each distinct point in an explanation of how the design of the Future Pump bottle enables a reduction of energy consumption at the pre-production stage of the life cycle up to **[3 max]**.* *Award **[1]** for each distinct point in an explanation of how the design of the Future Pump bottle enables a reduction of energy consumption at the production stage of the life cycle up to **[3 max]**.* *Award **[1]** for each distinct point in an explanation of how the design of the Future Pump bottle enables a reduction of energy consumption at the disposal stage of the life cycle up to **[3 max]**.* *Do not award marks between clusters.* *Mark as **[3]** + **[3]** + **[3]**.*	**9**