Markscheme

November 2024

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	constructive discontent; economic gain;	*Award **[1]** for stating one driver for invention used by Warwick Music Group up to **[1 max]**.*	1
1.	a	ii	biomechanics considers human mechanics/movement; taking into account strength of the user/type of force required;	*Award **[1]** for identifying a reason why biomechanics is important with the pTrumpet design and **[1]** for a development of that reason up to **[2 max]**.*	2
1.	b	i	reduction of total material; reduction of number of parts;	*Award **[1]** for listing each way how injection moulding contributes to the dematerialization of the ABS **plastic pTrumpet** up to **[1 max]***	2
1.	b	ii	thermoplastic; reheated and reshaped; / Heat has a reversible effect on the material/have weak/secondary bonds between the linear chain molecules;	*Award **[1]** for identifying a reason what makes ABS easy to recycle and **[1]** for a development of that reason up to **[2 max]**.*	2
1.	c	i	toughness; the ability of a material to resist the propagation of cracks;	*Award [1] for **identifying the mechanical properties** of ABS plastic that makes it suitable for the pTrumpet and [1] for a **description of the identified property** up to [2 max]*	2
1.	c	ii	an improvement in the organisation and/or method of manufacture; using injection moulding; resulting in speed/efficiency in manufacture/reduction in cost; increasing rate of production;	*Award **[1]** for identifying how process innovation applies to the development of the pTrumpet and **[1]** for each subsequent development of that strategy up to **[3 max]**.*	3

Question 1 continued

Question			Answers	Notes	Total
1.	d	i	Reducing material; reducing pollution; reducing use of energy; reducing wastage of energy/resources; legislation; consumer/pressure groups/media; promoting positive impacts; minimizing negative impacts through conserving natural resources;	*Award **[1]** for stating the driver for employing clean technology in using only injection moulding as the manufacturing method of the pTrumpet up to **[1 max]**.*	**1**
1.	d	ii	cost effective; as it is a high volume/automated/mechanized production system; repeatability/consistency; as the exact same mould is utilized to produce all parts; high precision/accuracy; allows detailed features/complex shapes/textures/surface finishes/ reducing defects; efficient use of material; the same manufacturing process is utilized to produce all parts/no waste/reduces waste;	*Award **[1]** for identifying an advantage of using injection moulding for the manufacturing of the ABS pTrumpet and **[1]** for an appropriate development up to **[2 max]**.*	**2**

Question 1 continued

Question			Answers	Notes	Total
1.	**e**	**i**	user's opinions can vary/rank order about the level of comfort/discomfort; collect data from a range of users in a time efficient manner;	*Award **[1]** for identifying why an ordinal scale is used to determine the comfort of users of the pTrumpet and **[1]** for an appropriate development up to **[2 max]**.*	**2**
1.	**e**	**ii**	conceptual modelling begins in the mind/with the designer's imagination; human resources/technology to implement is followed by the use of physical/graphical /CAD models to enable designers to communicate the broader concept/idea to the design/manufacturing/client/user; to gain feedback/gauge their reaction/aid further development; it is inexpensive/does not waste materials; can aid discussion with users/manufacturers/clients; to enable the process to move quickly to the next development stage/iteration;	*Award **[1]** for identifying a benefit for using conceptual modelling in the early parts of the design phase of the pTrumpet. and **[1]** for each subsequent development of that reason up to **[3 max]***. Mark as one cluster	**3**

Question			Answers	Notes	Total
2.	**a**		image; mass production; ubiquitious; omniprésence; dominant design; culture; timeless;	*Award **[1]** for listing* each *characteristic that make the Bialetti Moka Express coffee maker a design classic up to **[2 max]**.*	**2**
2.	**b**		The form follows function; the form is distinctive/angled/minimalist style/natural finish; does not affect the function of holding/pouring/boiling water; compact design with heating elements all contained in one product; The different angles in the form indicate the location of disassembly;	*Award **[1]** for identifying a way that Alfonso Bialetti, the designer of the Bialetti Moka Express coffee in **Figure 5** has achieved a balance between form and function and **[1]** for a development of that characteristic up to **[2 max]**.*	**2**
3.			an influential individual/has excellent business acumen/experience/knows the market; working within an organization; helps promote the product/develops an enthusiasm for a particular product;	*Award **[1]** for* identifying the role of a product champion within an organisation *and **[1]** for each subsequent development of that physiological benefit up to **[3 max]**.*	**3**
4.			a CAD model is converted into slices/layers; which are then cut individually using a laser/plotter/cutter/ CNC machine; then slices/layers are glued/joined/assembled together to create a 3D physical model;	*Award **[1]** for identifying how laminated object manufacture (LOM) is used in rapid prototyping and **[1]** for each subsequent development of that reason up to **[3 max]**.*	**3**

Section B

Question			Answers	Notes	Total
5.	**a**		assembly drawing/exploded isometric; showing how components fit together/make it a whole;	*Award **[1]** for identifying the type graphic modelling used to communicate the construction of the Flow Hive for the user as shown in **Fig 7**and **[1]** for a reason up to **[2 max]**.*	**2**
5.	**b**		a business practice in which a company produces different models of the same product; to reach a wider audience/offer a wider range/increasing sales/extending market share/meet demand; incremental solutions;	*Award **[1]** for explaining one advantage of the Flow Hive company introducing new versions of the Flow Hive shown in **Fig 8** and **[1]** for each subsequent development of that reason up to **[3 max]**.*	**3**
5.	**c**		LCA is costly/time consuming; it requires specialist knowledge on the product life cycle stages; which Flow as a small company may not have the skill/human resources/technology to implement; small companies such as Flow usually have a low rate of production; which may have less negative impact on the environment; and do not see LCA as a priority;	*Award **[1]** for identifying* a reason why Flow may not adopt life cycle analysis as a strategy for reducing the environmental impacts of its various products *and **[1]** for each development of that way up to **[3 max]**.* *Mark as **[3]** + **[3]***	**6**

Question 5 continued

Question			Answers	Notes	Total
5.	**d**		**density** the mass per unit volume of a material; plywood has a low density; leading to reduced cost/emissions/air pollution during transportation; **compressive strength** the ability of a material to withstand being pushed/squashed; Plywood will withstand the weight of the different hive Assemblies/parts/compartments stacked on top of each other; offering high strength to weight ratio; **aesthetic appeal** the aspects of the Flow Hive that relate to its appearance; Plywood gives option to keep the natural wood grain/fits into natural environment; or paint/change colour to meet user's personal choice;	*Award **[1]** for explaining how the density of plywood makes it suitable for the Flow Hive up to **[3 max]**.* *Award **[1]** for explaining how its compressive strength makes plywood suitable for the Flow Hive up to **[3 max]**.* *Award **[1]** for explaining how the aesthetic appeal of plywood makes it suitable for the Flow Hive up to **[3 max]**.* *Mark as **[3]** + **[3]** + **[3]**.*	**9**

Question			Answers	Notes	Total
6.	**a**		solid models provide a complete set of data allowing the product to be realized/tested/virtually prototyped /rapid prototyped/undergo FEA; surface models contain no data about wall thickness/interior (components) of the part;	*Award **[1]** for why solid modelling would have been used in the development of the Tricky Drill and **[1]** for a reason up to **[2 max]**.*	**2**
6.	**b**		the Tricky Drill's alloy case is made entirely from recycled alloy/waste; avoiding the need for raw/new materials; reducing the overall energy/natural resource consumption;	*Award **[1]** for explaining how the manufacture of the Tricky Drill alloy case addresses the green design objective of waste up to **[3 max]**.*	**3**
6.	**c**		***Compatibility*** *consumers will be attracted to the Tricky Drill as it relates to their own experiences;* *as users may have had accidents/time consuming experiences from other drills;* *therefore increasing the rate of adoption;* *the level of compatibility that an innovation has to be assimilated into an individual's life;* *as the Tricky Drill has the same dimensions/characteristics/properties as existing drills on the market;* *and important to consumers that the Tricky Drill can work with existing drill bit/drilling systems that they use;* ***Relative advantage*** *Relative advantage refers to the degree to which an innovation is perceived to be better than the existing solution it aims to replace;* *the main attribute of the drill is the safety feature of using ultrasonic waves to identify foreign objects concealed inside a wal/lightweight;* *so consumers who view this as a positive attribute/relative advantage will help increase the rate of adoption;*	*Award **[1]** for identifying how compatibility will affect consumer adoption of an innovation such as the Tricky Drill and **[1]** for each subsequent development of it up to **[3 max]**.* *Award **[1]** for identifying how relative advantage will affect consumer adoption of an innovation such as the Tricky Drill and **[1]** for each subsequent development of it up to **[3 max]**.* *Mark as **[3]** + **[3]**.*	**6**

Question			Answers	Notes	Total
6.	**d**		**Comfort:** anthropometric data can help determine the shape and size of the handle/grip/display panel; based on hand anthropometrics; based on the suitable percentile range/anthropometric data/field of vision; to maximise the user's comfort/minimising fatigue/discomfort/strain over a long duration of time; **Safety:** anthropometric data can be used to test the best handling/gripping position/position of display panel; to allow for optimal clearance/holding position/see the panel for the user; to ensure safe/wearing of safety equipment/gloves/minimising risk of accidents. **Performance:** anthropometric data can be used to ensure optimal reach of controls/trigger/power button/display panel; which allows efficiency/ease of operation; to maximize productivity;	*Award **[1]** for explaining how the use of anthropometric data can help improve the design of the Tricky Drill with respect to its comfort up to **[3 max]**.* *Award **[1]** for explaining how the use of anthropometric data can help improve the design of the Tricky Drill with respect to its safety up to **[3 max]**.* *Award **[1]** for explaining how the use of anthropometric data can help improve the design of the Tricky Drill with respect to its performance up to **[3 max]**.* *Mark as **[3]** + **[3]** + **[3]**.*	**9**

Question			Answers	Notes	Total
7.	**a**		the target audience/market is the group the product is aimed at; the target audience/market for the BLAVOR power bank are outdoor enthusiasts;	*Award **[1]** for identifying the target audience for the solar powered BLAVOR power bank **[1]** for a development of it up to **[2 max]**.*	**2**
7.	**b**		it is a renewable energy/infinite source/minimises energy derived from fossil fuels; Solar panels are portable/lightweight/compact/enabling the user to charge devices on the go; reducing the use on non-rechargeable batteries/impact on landfill/toxins in the environment;	*Award **[1]** for explaining the advantage of using solar power as a charging method for the BLAVOR power bank and **[1]** for each subsequent development of it up to **[3 max]**.*	**3**

Question 7 continued

Question			Answers	Notes	Total
7.	**c**		automation is a volume production process involving machines controlled by computers; as machines can perform the tasks faster/more efficiently/with greater accuracy/higher quality; leading to no faults/waste/ lowering operating costs; automation is a volume production process involving machines controlled by computers; automated cells remove workers from dangerous tasks/improve worker safety; safeguarding them against the hazards of a factory environment; automation is agile/reduce factory lead times/faster return of investment; can improve process control/significantly reduce lead times/meet demand; have the ability to be more competitive; automation allows for flexibility/various tasks; enables machines to be retooled for various processes; increases production output; ability to program/make changes to the process with no disruption to existing processes; work at a constant speed/unattended, 24-7; producing higher volume/on demand; automated perform the manufacturing process with less variability than human workers; this results in greater control/consistency; increasing product quality;	*Award **[1]** for* each advantage of automation as a production system for the BLAVOR power bank *and **[1]** for each subsequent development of it up to **[3 max]***. *Mark as **[3]** + **[3]**.* *Do not award marks between clusters*	**6**

Question 7 continued

Question			Answers	Notes	Total
7.	**d**		**aesthetic models:** prototypes developed to look and feel like the final product; used to evaluate the aesthetic appeal; such as shape/colour/texture/graphic symbols; **Prototypes:** prototypes are built to test a concept/process/act as an object to be replicated or learned from; used to test the mechanism/function of the solar panel; ensuring the solar panel can fold up/compact/ease of use/efficiently charges the batteries; **instrumented models:** prototypes equipped with the ability to take measurements/accurate quantitative feedback for analysis; measuring the tensile/compressive forces/measuring efficiency of energy/light conversion; ensuring the strength of the solar panels/internal casing components are resistant to external pressure;	*Award **[1]** for explaining how aesthetic models, were used in the development of the solar powered BLAVOR power bank up to **[3 max]**.* *Award **[1]** for explaining how prototypes were used in the development of the solar powered BLAVOR power bank up to **[3 max]**.* *Award **[1]** for explaining how instrumented models were used in the development of the solar powered BLAVOR power bank up to **[3 max]**.* *Do not award marks across clusters.* *Mark as **[3]** + **[3]** + **[3]**.*	**9**