

Markscheme

November 2021

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 force for acceleration .	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	The ability of a material to return to its original shape (after being deformed);	<p><i>Award [1] for defining the term elasticity.</i></p> <p><i>(Answer in brackets not required for the mark)</i></p> <p><i>Do not accept the words 'stretch' or 'pull' without reference to returning to its original shape</i></p>	1
1.	a	ii	The material goes from being elastic to plastic/undergoes plastic deformation; Which means it will not be able to return to its original shape/deforms permanently;	<p><i>Award [1] for each part of a description of what happens when the stress on a material causes it to exceed its yield point up to [2 max].</i></p> <p><i>Do not accept 'break'</i></p>	2
1.	b	i	Biomechanical data measures mechanics/forces of the user (living organisms); To determine the strength/effort required to grip/squeeze/compress the forceps;	<p><i>Award [1] each part of a description of how biomechanical data would have been used in the development of the forceps up to [2 max].</i></p>	2
1.	b	ii	<p>Design for assembly; Additional workers/machines are not required to assemble the parts;</p> <p>Design for manufacturing; No assembly required resulting in higher production rate/less energy consumed;</p> <p>Design for process; Optimisation of a single process (such as injection moulding/die casting);</p> <p>Design for materials; Optimize economies of scale;</p>	<p><i>Award [1] for identifying how products that are produced as a single part can reduce manufacturing costs [1] for a brief explanation up to [2 max].</i></p> <p><i>Do not award marks between clusters.</i></p>	2

Question			Answers	Notes	Total
1.	c	i.	Design for disassembly allows products to be taken apart; Which allows for cleaning/repair/replacing/maintenance of parts;	<i>Award [1] for identifying how design for Disassembly can help extend the life span of products with multiple parts and [1] for a brief explanation up to [2 max].</i>	2
1.	c	ii	Finite Element Analysis (FEA) can test the strength/load of a joining method/technique (using CAD); When under stress/force; In order to make modifications/improvements;	<i>Award [1] for identifying how Finite Element Analysis (FEA) can be used to test products with multiple parts and [1] for each distinct explanation up to [3 max].</i> <i>(Answer in brackets not required for the mark)</i>	3

Question 1 continued

Question			Answers	Notes	Total
1.	d	i.	Fasteners/knock-down fittings/nuts and bolts/screws;	<i>Award [1] for stating a possible joining method used to attach the legs to the other parts of the desk up to [1 max]. Do not accept 'nails'</i>	1
1.	d	ii.	5 th percentile; So that 95% of the majority of the population can reach the dividers/to cater for the shortest reach;	<i>Award [1] for identifying the percentile range used to calculate the reach from the front of the desk to the coloured dividers and [1] for a brief explanation up to [2 max].</i>	2
1.	e	i.	Mass production; Allows more consumers to own the product/makes it more affordable/meets demand; Defies obsolescence; By transcending its function;	<i>Award [1] for identifying one reason how the Nelson Swag Leg Desk achieved classic design status and [1] for a brief explanation up to [2 max].</i>	2
1.	e	ii.	Social impact; Deforestation/loss of habitat/human displacement; Causing local unrest/people to migrate/unemployment/negative economic impact; Environmental impact/reduction of CO ₂ absorption/renewability; Hardwoods can only be replaced over a long period; Affecting a country's obligation to global sustainability agreements/targets; Biodiversity; Forests are home to flora/wildlife populations that are under threat; That can wipe out species/affect the reputation of a country;	<i>Award [1] for a distinct point for why the depletion of hardwood reserves may have political implications and [1] for each distinct explanation up to [3 max]. Do not award marks between clusters.</i>	3

Question		Answers	Notes	Total
2.	a	Composites; Polymers;	<i>Award [1] for listing each material that can be shaped using resin-transfer moulding up to [2 max].</i>	2
2.	b	Conventional Machining; Injection Moulding;	<i>Award [1] for listing each suitable process for a ceramic component with a mass of 10kg up to [2 max].</i>	2
3.		Thermoplastics have a linear chain structure/weak polymer bonds; Which allows them to be heated and reformed; Into a new shape repeatedly;	<i>Award [1] for identifying how the molecular structure of thermoplastics is affected by heat and [1] for each development of the explanation up to [3 max].</i>	3
4.		Due to consumer pressure/legislation; Considering materials/energy/pollution/waste; To meet consumer demand/targets;	<i>Award [1] for each distinct point in an explanation of why designers would consider impact on the environment as a criterion for selecting manufacturing processes up to [3 max].</i>	3

Section B

Question		Answers	Notes	Total
5.	a	Data modelling is used to determine the structure/display/organisation of data; To communicate the weather/air quality/temperature/humidity/allergens;	<i>Award [1] for identifying a reason how data modelling could have been used in the development of the Aria smartphone app and [1] for a brief explanation up to [2 max].</i>	2
5	b	Disposable products can end up in landfill/incineration; Toxic materials/waste/gas can leach/escape into the environment; Causing soil/water/air pollution; Disposable products require resources to be extracted; Depleting resource reserves; Causing habitat destruction/soil degradation/damage to ecosystems; Disposable products require large scale production; Which use energy/create pollution in manufacture; Reducing air/soil/water quality/increasing greenhouse gas/CO ₂ emissions;	<i>Award [1] for identifying how disposable products can have a negative impact on the environment and [1] for each distinct explanation up to [3 max].</i> <i>Do not award marks between clusters.</i>	3

Question 5 continued

Question		Answers	Notes	Total
5.	c	<p>Refillable device; Cartridge does not need to be replaced when it runs out; Does not create waste through empty canisters being disposed;</p> <p>Choice of form/colour/style/different product versions; Appeals to different target audiences/creates personal attachment; Which extends product life;</p>	<p><i>Award [1] for each distinct point in an explanation of how the design team have addressed the problem of disposability through the design the Aria asthma inhaler up to [3 max].</i></p> <p><i>Do not award marks between clusters</i></p> <p><i>Mark as [3] + [3].</i></p> <p><i>Do not accept 're-use'</i></p>	6
5.	d	<p>Relative advantage: How improved an innovation is over a previous generation; As it uses technology/is refillable Providing data on individual's usage/reduces waste;</p> <p>Compatibility: How the inhaler is perceived as being assimilated into someone's life; The inhaler has four versions (youth, contemporary, sport and heritage); Attracting a range of target audiences;</p> <p>How the inhaler is perceived as being compatible with other devices; The inhaler is supported by a smartphone app; Which can be used across different technologies/smartphones;</p> <p>Observability: The extent to which the product is observable/visible to others; The inhaler has distinct shape; Making it more recognisable;</p>	<p><i>Award [1] for each distinct point in an explanation of the role of relative advantage, compatibility and observability on the rate of adoption of the Aria asthma inhaler up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p> <p><i>Do not award marks between clusters</i></p>	9

Question		Answers	Notes	Total
6.	a	<p>Freehand sketching; Isometric drawing; Perspective drawing; Orthographic projection/working drawing; Part/assembly drawing; Exploded view; Scale drawing;</p>	<p><i>Award [1] for listing each form of graphical modelling used by car designers up to [2 max].</i></p> <p><i>Do not accept 'CAD' drawing</i></p>	2
6.	b	<p>Scientific/technical curiosity; Investigating/development of new materials/processes; To improve on existing cars;</p> <p>Desire to help others; Carbon emissions are a cause of climate change; Has a negative impact on people around the world;</p> <p>Constructive discontent; Analysing a situation that benefits from redesign; By reducing carbon emissions/pollution/impact on climate change;</p>	<p><i>Award [1] for each distinct point in an explanation of a driver for invention of the NCV up to [3 max].</i></p> <p><i>Do not award marks between clusters</i></p>	3

Question 6 continued

Question		Answers	Notes	Total
6.	c	<p>Light: Windows; Can increase visibility/the amount of natural light; Improves mental focus/reduces fatigue;</p> <p>Headlights/interior/dashboard lighting; Improves visibility when driving at night; Which increases safety;</p> <p>Sound: Audible feedback (from controls); Can help the driver understand actions undertaken; Reassures/notifies the driver of any further actions required;</p> <p>Warning signal/sounds; Alerts the driver instantly; To take necessary action (in response to a situation);</p>	<p><i>Award [1] for each distinct point that explains how light and sound could be used by designers of the NPV to improve the alertness of the user up to [3 max].</i></p> <p><i>Do not award marks between clusters</i></p> <p><i>Mark as [3] + [3].</i></p> <p><i>(Answer in brackets not required for the mark)</i></p>	6

Question 6 continued

Question		Answers	Notes	Total
6.	d	<p>Pre-production: Nano cellulose is made from unused/waste biomass/locally sourced materials; Raw material does not need to be extracted; Lowering energy required/carbon emissions from extraction;</p> <p>Utilization: Nano cellulose is lightweight (one fifth the weight of steel); Requires less energy to power the car; Reduction in fossil-fuels burnt/less energy (charging) required;</p> <p>Nano cellulose is strong (five times stronger than steel); Meaning the car would perform better in collisions/on impact; Enhancing the safety of the vehicle;</p> <p>Nano cellulose has a high strength to weight ratio; Requiring less fuel/energy; Reducing cost/environmental impact;</p> <p>Disposal: Nano cellulose is a natural material; Making it biodegradable; Allowing for easier disposal/reduction in energy/toxic pollution/lowering impact on the environment/landfill;</p>	<p><i>Award [1] for each distinct point in an explanation of how the use of nano cellulose impacts the pre-production, utilization and disposal stages of the Nano Cellulose Vehicle's life cycle up to [3 max].</i></p> <p><i>Do not award marks between clusters</i></p> <p><i>Mark as [3] + [3] + [3].</i></p> <p><i>(Answer in brackets not required for the mark)</i></p>	9

Question		Answers	Notes	Total
7.	a	Density; Higher mass/weight to aid stability;	<i>Award [1] for identifying one physical property that makes hardwood a suitable choice for the base for the Gramovox bluetooth speaker and [1] for a brief explanation up to [2 max].</i>	2
7.	b	Retro-styling uses the decoration/style/appearance from a particular period of time; The S-curve horn of the Gramovox mimics the shape of gramophones from the past (1920's); Using bluetooth/up to date/new technology.	<i>Award [1] for each distinct point in an explanation of how retro-styling has been used in the design of the Gramovox bluetooth speaker up to [3 max].</i> <i>(Answer in brackets not required for the mark)</i>	3
7.	c	Entrepreneur An influential individual who can take an invention to market; Bapu created a crowdfunding campaign to support the development of the speaker; Lowering financial risk (for him/the company); Product champion Develops enthusiasm for a particular idea or invention/champions an idea within the organization; Bapu saw a business opportunity in the retro-styling of the speaker; Promoting the product through online platforms/broadcasts/interviews;	<i>Award [1] for each distinct point in an explanation of Pavan Bapu's role as entrepreneur and product champion in the success of the Gramovox bluetooth speaker up to [3 max].</i> <i>Mark as [3] + [3].</i> <i>(Answer in brackets not required for the mark)</i>	6

Question 7 continued

Question		Answers	Notes	Total
7.	d	<p>Freehand sketches: Rough drawings/sketches used to convey/communicate an idea; In a quick/easy/cost effective way; To record/improve ideas as idea development progresses;</p> <p>Physical models: The creation of a (smaller or larger) tangible version of an object (that can be physically interacted with); To test/evaluate the aesthetic/function/performance; And provide feedback that enables the designer to modify/improve the speaker;</p> <p>Solid models: Provides a complete set of data for the product to be realised; Used for simulations/feedback (of the assembly/materials/performance of the speaker); Saving on time/labour (without the need of a physical model);</p>	<p><i>Award [1] for each distinct point in an explanation of the benefit of using freehand sketches, physical models and CAD solid models in the development of the horn of the Gramovox bluetooth speaker up to [3 max].</i></p> <p><i>Do not award marks between clusters.</i></p> <p><i>Mark as [3] + [3] + [3].</i></p> <p><i>(Answer in brackets not required for the mark)</i></p>	9