

Markscheme

November 2019

Design technology

Higher level and standard level

Paper 2

15 pages

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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 tick (✓) 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	6% ✓	<i>Award [1] for stating the percentage of Greenfeet's impact from water pollution.</i>	1
1.	a	ii	Reduction in/depletion of non-renewable resources ✓ Increased energy use from raw material extraction/during manufacturing ✓ Environmental degradation of areas/landscapes where materials are extracted ✓ Negative social impact on communities where materials are extracted ✓ Increases pollution (from processing high quantities of material) ✓ Added wastage ✓ Storage requirements (of materials) ✓	<i>Award [1] for listing each of two consequences of a manufacturing process that uses large quantities of raw materials up to [2 max].</i> <i>Answer in brackets is not required to award the mark.</i>	2
1.	b	i	The shoe uses waste material (plastics) recovered from the ocean ✓ By recycling it for production of the shoe uppers ✓	<i>Award [1] for identifying how the Greenfeet Vertue shoe is an example of waste mitigation and [1] for a brief explanation.</i> <i>Answer in brackets is not required to award the mark</i> <i>Do not accept 're-use' or 're-purpose'.</i>	2

Question			Answers	Notes	Total
1.	b	ii	<p>Promoting positive impacts/enhancing image ✓ Which will appeal to customers/increase sales ✓</p> <p>Ensuring neutral impact or minimizing impacts through conserving natural resources ✓ By recycling waste/promoting the recovery of waste from the ocean ✓</p> <p>Government targets/legislation ✓ Which can help the manufacturer reduce pollution/use of energy ✓</p> <p>Reducing wastage of energy/resources ✓ Which can increase profits by lowering production costs ✓</p>	<p><i>Award [1] for identifying a driver for cleaning up manufacturing and [1] for a brief explanation.</i></p> <p><i>Do not award marks between clusters.</i></p>	2
1.	c	i	<p>To explore form/style/aesthetics ✓ And easily/quickly/cost effectively communicate to/gather feedback from clients ✓</p> <p>Freehand/rough drawings of designs/concepts ✓ Can be used to convey/visualise/refine/develop the idea ✓</p>	<p><i>Award [1] for identifying why sketches would be used in the development of the Greenfeet Vertue shoe and [1] for a brief explanation.</i></p>	2

Question			Answers	Notes	Total
1.	c	ii	Comfort ✓ The design of the sole needs to consider the size/movement of the user ✓ To ensure it does not create any pressure/pain ✓ Fatigue ✓ Users may wear the shoes for long periods of time ✓ And they should be able to flex/feel light/not cause tiredness ✓	Award [1] for identifying a physiological factor considered in shoe sole design and [1] for each distinct explanation up to [3 max] . Do not award marks between clusters.	3
1.	d	i	Two diagonal stripes ✓ Similar panel pattern ✓ EVA rubber sole ✓ Colour scheme ✓	Award [1] for listing a characteristic that the retro-styled Greenfeet Climeate shoe (2019) shares with the Greenfeet Climeate shoe (2004) up to [1 max] .	1
1.	d	ii	5th – 95th percentile (of adult population) ✓ To fit the majority of the population ✓	Award [1] for identifying the maximum and minimum percentiles that Greenfeet would use when manufacturing the Climeate shoe and [1] for a brief explanation. Answer in brackets is not required to award the mark.	2
1.	e	i	EVA rubber pieces are placed into the mould ✓ And are compression moulded (with heat) ✓	Award [1] for describing the process of how the EVA rubber sole of the Greenfeet Climeate shoe is moulded and [1] for identifying the moulding technique [2 max] . Answer in brackets is not required to award the mark.	2

Question			Answers	Notes	Total
1.	e	ii	<p>The shoe is modern/contemporary/minimally styled/fashionably appealing ✓ Whilst still meeting the basic functional requirements of a sports/leisure shoe ✓ Therefore, achieving a good balance between form and function ✓</p> <p>The shoe is designed/intended as a casual lifestyle shoe ✓ With limited technical features ✓ Therefore, prioritising form over function ✓</p> <p>The focus of the shoe is to provide comfort/durability ✓ But with limited aesthetic appeal to a wider audience ✓ Therefore, prioritising function over form ✓</p>	<p><i>Accept any valid discussion similar to the 3 suggested clusters.</i></p> <p><i>Award [1] for a distinct point of how the Greenfeet Climeate shoe (2019) balances the compromise between form and function up to [1 max].</i></p> <p><i>OR</i></p> <p><i>Award [1] for a distinct point of how the Greenfeet Climeate shoe (2019) does not balance the compromise between form and function up to [1 max].</i></p> <p><i>Award [1] for an evaluative statement.</i></p> <p><i>Do not award marks between clusters.</i></p>	3

Question		Answers	Notes	Total
2.	a	Subtractive manufacturing ✓ Machining/drilling/cutting/abrading/turning is used to remove the material (from the solid block of wood) ✓	<i>Award [1] for identifying the manufacturing process used to create the Streamliner Classic body from a block of wood up to [2 max].</i> <i>Answer in brackets is not required to award the mark.</i>	2
2.	b	Mass customization ✓ A (CIM) system that manufactures products to individual customer needs/specifications/orders ✓	<i>Award [1] for identifying the production system used that allows customers to design their own toy car on their website, choosing shape, colour and wheel style and [1] for a brief explanation.</i> <i>Answer in brackets is not required to award the mark.</i>	2
3.		Copyright ✓ A legal right that grants the creator of an original work exclusive ownership for its use and distribution (Usually for a limited time and within geographical boundaries)✓ This protects the song as people who copy/download/play the song (illegally) will be required to compensate the musician for the infringement ✓	<i>Award [1] for identifying a strategy a musician would use to protect a new song and [1] for each distinct explanation up to [3 max].</i> <i>Answer in brackets is not required to award the mark.</i>	3
4.		Second-generation robots can perform a range of (complex) tasks ✓ Using various/different inputs and outputs ✓ Making manufacturing faster/more efficient/lower cost ✓ Second-generation robots are equipped with sensors ✓ That can provide information about their surroundings/allow them to synchronize with each other ✓ And do not require constant supervision by a human ✓	<i>Award [1] for each of three distinct points in an explanation of the advantage of using second generation robots instead of first generation robots in manufacturing.</i> <i>Answer in brackets is not required to award the mark.</i> <i>Do not award marks between clusters.</i>	3

Section B

Question		Answers	Notes	Total
5.	a	Reluctant to embrace new products/technology ✓ Are the last to adopt an innovation ✓ Tend to prefer traditions ✓ Are unwilling to take risks ✓ Make up 16% of the market ✓	Award [1] for listing each characteristic of a laggard up to [2 max] .	2
5.	b	Batch production ✓ A specified number/272 of the Route Master buses are made ✓ To determine the success/popularity of the buses before going into larger scale production ✓	Award [1] for identifying the scale of production that would be used for the Routemaster bus and [1] for each distinct explanation up to [3 max] .	3
5.	c	<p>Virtual prototyping: Are CAD-based/photorealistic/interactive models that use surface and solid modelling ✓ An advantage of virtual prototyping is that the designers can communicate with users without building a physical model/prototype ✓ Which can be expensive/difficult/time consuming ✓</p> <p>Full scale physical modelling: Are tangible versions of an object that can be physically interacted with ✓ An advantage of full scale physical modelling is that users can evaluate the interior/seats/cockpit design of the bus (at actual size) ✓ Which enables designers to test the design with a range of users ✓</p>	Award [1] for each of three distinct points in an explanation of the advantages of using virtual prototyping and full scale physical modelling to get feedback during the design development of the Routemaster bus. Mark as [3] + [3] . Answer in brackets is not required to award the mark.	6

Question		Answers	Notes	Total
5.	d	<p>Clearance: Refers to the space between two objects ✓ There must be sufficient space between the driver and the steering wheel (accept indicators, levers, switches, controls) ✓ To ensure the driver can effectively operate/get in and out of the seat/bus ✓</p> <p>Reach: Refers to the range that a person can stretch/move to touch/grasp an object from a specified position ✓ The driver must be able to reach the steering wheel/surrounding instruments from the cockpit ✓ Without it affecting their ability to safely operate/maintain control of the bus ✓</p> <p>Adjustability: Refers to the ability of a product to change in size/increase the range of percentiles that a product is appropriate for ✓ The driver's seat needs to be adjusted to the correct height and distance from the steering wheel for different sized drivers ✓ To enable them to comfortably operate the steering wheel/instruments/bus ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of how the design of the driver's cockpit of a Routemaster bus considers clearance, reach and adjustability.</i></p> <p><i>Mark as [3] + [3] + [3].</i></p> <p><i>Answer in brackets is not required to award the mark.</i></p>	9

Question		Answers	Notes	Total
6.	a	A composite is a material comprised of two or more materials (with different properties) ✓ Which combine to create a stronger material ✓	<i>Award [1] for identifying why these bricks are an example of a composite material and [1] for a brief explanation.</i> <i>Answer in brackets is not required to award the mark.</i>	2
6.	b	Prototypes are used to test a concept or process/act as an object to be replicated/learned from ✓ This helps evaluate the strength of the bricks ✓ And determine the optimum combination/percentage/ratio/mixing of materials ✓	<i>Award [1] for each of three distinct points in an explanation of why prototypes would be used in the testing and evaluation of the Treak Village plastic brick.</i>	3
6	c	Cost constraints: There should not be any added costs to the production of the bricks ✓ Including labour/raw materials/machinery/tools/equipment ✓ To keep them affordable for the local community ✓ Material requirements: Properties of the material should not be decreased by the introduction of the plastic fibres ✓ To ensure/maintain compressive strength of the brick ✓ Making the bricks be able to withstand a load/fit for purpose ✓	<i>Award [1] for each of three distinct points that suggest the cost constraints and material requirements for the Treak Village plastic brick.</i> <i>Mark as [3] + [3].</i>	6

Question		Answers	Notes	Total
6	d	<p>Materials: The plastic brick uses plastic produced from waste ✓ This replaces the aggregate/stone that would otherwise be used in the brick ✓ Reducing the quantity of raw materials used in the production of the brick ✓</p> <p>Energy: The concrete for the plastic bricks is mixed/moulded by hand/locally ✓ This requires less energy than manufacturing bricks commercially ✓ Reducing energy used in production/transportation ✓</p> <p>Waste: The plastic brick reduces the amount of waste remaining/circulating in the environment ✓ By recycling the plastic found locally ✓ So it is no longer visually polluting/causing contamination ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of how the manufacture of the Treak Village plastic brick addresses the green design objectives of materials, energy and waste.</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9

Question		Answers	Notes	Total
7.	a	<p>Taste ✓ The kitchenware should not release any chemical/taste/flavour/residue/contamination onto the food being served ✓</p> <p>Smell ✓ The kitchenware should not release any unpleasant odour/smell ✓</p> <p>Sound ✓ The kitchenware should be smooth to make it easy to clean/use ✓</p>	<p><i>Award [1] for identifying one psychological factor the Zuperzozial kitchenware needs to consider and [1] for a brief explanation.</i></p> <p><i>Do not award marks between clusters.</i></p>	2
7.	b	<p>Hardness ✓ The kitchenware needs to resist scratching ✓ When used with knives/forks/cutlery on its surface ✓</p> <p>Weight ✓ The kitchenware must not be too heavy ✓ Which would make it difficult to use/hold/carry ✓</p> <p>Thermal conductivity ✓ The kitchenware should not readily conduct excess heat ✓ When used with hot food/warming food (in an oven) ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of one physical property that the material used in the Zuperzozial kitchenware needs to possess up to [3 max].</i></p> <p><i>Do not award marks between clusters.</i></p>	3

Question		Answers	Notes	Total
7.	c	<p>Finite Element Analysis: FEA allows the calculation and simulation of unknown factors in products using CAD systems ✓ Which can be used to test the mechanical/physical properties (accept compressive strength/tensile strength/toughness/hardness/density/weight/mass) ✓ And allows for quick/easy/cost effective modifications to the design (based on the results of testing) ✓</p> <p>Physical models: Physical models allow the creation of a tangible version of an object that can be physically interacted with ✓ To help evaluate size/proportions/texture of the design ✓ Which would provide more accurate/realistic feedback ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of the advantages of using FEA and physical models for testing the Zuperzozial kitchenware.</i></p> <p><i>Mark as [3] + [3].</i></p> <p><i>Answer in brackets is not required to award the mark.</i></p>	6

Question		Answers	Notes	Total
7.	d	<p>Relative advantage: How improved an innovation is over the previous generation ✓ The Zuperzozial kitchenware present an improvement over previous plates as they are made using biodegradable/ green materials ✓ This is important because consumers are unlikely to consider something more expensive unless they can see that it has an advantage ✓</p> <p>Compatibility: The level of compatibility that an innovation has to be assimilated into an individual's life ✓ The Zuperzozial plates have the same dimensions/characteristics/properties as existing plates so they are easily compatible with an individual's life ✓ It is important to consumers that the plates can work with the existing meals/storage/dishwasher/systems that they use ✓</p> <p>Observability: The extent that an innovation is visible to others ✓ Consumers can observe the Zuperzozial products via kitchen stores/ TV/magazines/social media/websites ✓ Which helps to diffuse the product into the market ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of how Rogers' characteristics of relative advantage, compatibility and observability help in the diffusion of the Zuperzozial kitchenware.</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9