

Markscheme

May 2022

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;	<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 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 required 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	increasing; rising;	<i>Award [1] for stating the trend of plastic production between 1950 and 2015. Award a mark for any appropriate word that describes an increase but do not accept terms such as 'positive trend' or 'improving'</i>	1
1.	a	ii	lightweight; low cost/cheap; easily shaped/moulded; non toxic/food safe; widely available; recyclable; waterproof/non absorbent;	<i>Award [1] for listing each reason why polyethylene terephthalate (PET) is often used for food packaging up to [2 max].</i>	2
1.	b	i	need to be separated; as they may fall into different recycling categories/have different recycling requirements; need to be separated; which can be time/energy consuming/costly;	<i>Award [1] for identifying a reason why products that are made of more than one material can be difficult to recycle and [1] for a development up to [2 max]. Do not award marks across clusters.</i>	2

Question			Answers	Notes	Total
1.	b	ii	government policy/legislation/regulations; infrastructure/capability/resources/facilities; public awareness/community driven;	<i>Award [1] for listing each reason why some countries recycle a larger percentage of plastics than others [2 max].</i>	2
1.	c	i	thermoplastics have a linear chain structure/weak secondary bonds; which allows them to be heated/melted and reformed/reshaped; thermosetting plastics have cross-linked chains/strong secondary bonds; which make them difficult to be heated/melted and reformed/reshaped;	<i>Award [1] for identifying why thermoplastics tend to be easier to recycle than thermosetting plastics and [1] for a development up to [2 max]. Do not award marks across clusters.</i>	2
1.	c	ii	incineration results in toxic chemicals being released into the atmosphere; resulting in pollution/harmful emissions; leading to health issues/damage to plants and wildlife; incinerating plastic waste requires high energy usage; which utilises fossil fuels; leading to high carbon emissions/climate change/global warming/depletion of finite resources;	<i>Award [1] for each distinct point in an explanation of one negative environmental impact of incinerating plastic waste up to [3 max]. Do not award marks across clusters.</i>	3

Question			Answers	Notes	Total
1.	d	i	cylindrical shape; wall thickness;	<i>Award [1] for stating how the plastic straw gains its stiffness up to [1 max].</i>	1
1.	d	ii	straws are high consumption/disposable/single-use items; creating demand for the product from retailers/consumers; large consumer base / target audience / target market; allows for benefits derived from economies of scale;	<i>Award [1] for identifying a reason why the plastic straw is mass produced and [1] for a development up to [2 max]. Do not award marks across clusters.</i>	2
1.	e	i	extrusion; allows for production be made quickly/in high volume;	<i>Award [1] for identifying an appropriate manufacturing method for making the plastic straw and [1] for a development up to [2 max].</i>	2
1.	e	ii	a new idea is needed as a result of demand from the marketplace; due to a greater awareness of the negative impact of plastic on the environment; resulting in consumer pressure for eco friendly alternatives to single use plastic products;	<i>Award [1] for each of three distinct points in an explanation of how market pull has influenced the release of the metal straw up to [3 max].</i>	3

Question		Answers	Notes	Total
2.	a	individual fibres are flexible (but lack strength); fibres woven/braided together provide high tensile strength;	<i>Award [1] for identifying one reason why rope fibres are important for the strength and flexibility of the rope and [1] for a development up to [2 max].</i>	2
2.	b	high tensile strength; elasticity;	<i>Award [1] for listing each property that enables rope to maintain its strength up to [2 max].</i>	2
3.		patents provides a company the (exclusive) right to make or sell a new invention; based on a (viable) market for the invention/revenue stream; providing high profit margins/market share;	<i>Award [1] for each of three distinct points in an explanation of why some patents may have more commercial value than others up to [3 max].</i>	3
4.		copyright grants the creator of an original work exclusive rights to its use and distribution; the intellectual property gives some protection against/prevents others from the copying of creative works; and provides compensation for intellectual effort;	<i>Award [1] for each of three distinct points in an explanation of how copyright is used in the creative arts as a method of protecting intellectual property up to [3 max].</i>	3

Section B

Question		Answers	Notes	Total
5.	a	hardness; high density; toughness;	<i>Award [1] for listing each property that made cast iron a suitable material for the Bailey Wood Plane up to [2 max].</i>	2
5.	b	innovation is putting an invention in the marketplace and making it a success; the wood plane offers adjustability; increasing the popularity/demand for the product/diffusion into the marketplace;	<i>Award [1] for each of three distinct points in an explanation of how the Bailey Wood Plane is an example of an innovation up to [3 max].</i>	3
5.	c	Omnipresence: the wood plane was invented in 1858; meaning it has existed/been in circulation for a long time; and continues to be used today (without change to the original design); Dominant design: dominant design contains features of a product that are recognized as essential (by a majority of manufacturers and purchasers); the wood plane contains a lever cap/adjuster/flat base/blade/handles; which are essential for the user to successfully plane wood/fulfil its function;	<i>Award [1] for each of three distinct points in an explanation of how the Bailey Wood Plane demonstrates omnipresence up to [3 max].</i> <i>Award [1] for each of three distinct points in an explanation of how the Bailey Wood Plane demonstrates dominant design up to [3 max].</i> <i>Mark as [3] + [3].</i>	6

Question		Answers	Notes	Total
5.	d	<p>Perspective drawings: provide a (realistic) 3D representation of the product; using foreshortening/converging lines/vanishing points; which can be used to communicate to clients/for marketing/promotional purposes;</p> <p>Orthographic projection: show the product from multiple 2D views (top/front/side); and provide dimensions/scale; which are helpful to communicate between designers/manufacturers;</p> <p>Exploded isometric drawings: a 3D drawing technique that illustrates the component parts separated (drawn on a 30° angle); used to show all the parts of the Bailey Wood plane (how they assemble/fit together); which helps the user with repair/assembly/maintenance of the product;</p>	<p><i>Award [1] for each of three distinct points in an explanation of why perspective drawings would be used in the design of the Bailey Wood Plane up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points in an explanation of why orthographic drawings would be used in the design of the Bailey Wood Plane up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points in an explanation of why exploded isometric drawings would be used in the design of the Bailey Wood Plane up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9

Question		Answers	Notes	Total
6.	a	<p>electric motorcycles use a battery/do not require fossil fuels to power the motor; which limits the need for finite energy sources;</p> <p>electric motorcycles do not emit harmful emissions/excessive noise during use (as they use a battery); which reduces air/noise pollution;</p>	<p><i>Award [1] for identifying why electric motorcycles are regarded as a green design and [1] for a development up to [2 max].</i></p> <p><i>Do not award marks across clusters.</i></p>	2
6.	b	<p>technology push because it underpins new ideas (electric motors and batteries); technology transfer because battery technology has been applied to the development of different types of products/systems (electric motorcycle); it is more likely to be technology push as there are strong drivers for the development of electric vehicles;</p>	<p><i>Award [1] for identifying why the development of the electric motor cycle is an example of technology push up to [1 max].</i></p> <p><i>Award [1] for identifying why the development of the electric motor cycle is an example of technology transfer up to [1 max].</i></p> <p><i>Award [1] for a concluding statement up to [1 max].</i></p>	3
6.	c	<p>some motorcyclists prefer motorcycles being noisy; sound provides appeal for certain (brands of) motorcycles; quiet electric motorcycles may therefore lead to reduced sales;</p> <p>quiet motorcycles may be regarded as being less safe; as pedestrians/other road users cannot hear the motorcycle coming (in traffic); causing potential risk/danger/injury to the rider/other road users;</p>	<p><i>Award [1] for each of three distinct points in an explanation of two ways the quiet nature of electric motorcycles may provide negative psychological factors in the popularity for consumers up to [3 max].</i></p> <p><i>Mark as [3] + [3].</i></p>	6

Question		Answers	Notes	Total
6.	d	<p>Production: materials for the components can be sourced from recycled materials; reducing the requirement for raw materials; meaning less energy is required to produce the electric motorcycle;</p> <p>automated production/robotic systems; minimises errors/increases efficiency in production; resulting in less (material and energy) waste produced;</p> <p>Distribution: the materials/components could be sourced from local manufacturers; reducing the amount of transportation required; resulting in less CO2 emissions;</p> <p>the motorcycles could be designed to be assembled at the point of sale; individual parts of the motorcycle take less space during transportation/distribution; so more motorcycles can be shipped per container;</p> <p>Disposal: the electric motorcycle can be designed for disassembly; allowing the materials/components to be separated easily; for repair/maintenance/reuse/re-engineering/re-conditioning/recycling;</p> <p>the manufacturer may consider using product recovery strategies; by the use of standard/recyclable components; which would reduce the volume of waste sent to landfill;</p>	<p><i>Award [1] for each of three distinct points of how the environmental impact can be minimised during production of the electric motorcycle up to [3 max].</i></p> <p><i>For production, do not accept 'recyclable' or 'renewable' materials</i></p> <p><i>Award [1] for each of three distinct points of how the environmental impact can be minimised during distribution of the electric motorcycle up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points of how the environmental impact can be minimised during disposal of the electric motorcycle up to [3 max].</i></p> <p><i>Do not award marks across clusters.</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9

Question		Answers	Notes	Total
7.	a	<p>disassembly (of blades/other parts to aid transport/storage);</p> <p>facilitates repair;</p> <p>ease of replacement/upgrade of parts;</p>	<p><i>Award [1] for listing each reason why temporary joining techniques are used when a drone is constructed up to [2 max].</i></p>	2
7.	b	<p>FEA provides calculation/simulation of unknown factors in the drone using CAD;</p> <p>which allows designers to test the drone's performance;</p> <p>to select optimum materials/structures/joining methods;</p>	<p><i>Award [1] for each of three distinct points in an explanation of why finite element analysis (FEA) would be used in the development of the drone up to [3 max].</i></p>	3
7.	c	<p>technological obsolescence;</p> <p>is when a product is no longer needed or wanted (even though it is in good working order);</p> <p>this would occur when an updated/more efficient version of a drone would replace an older version;</p> <p>functional obsolescence;</p> <p>occurs when a drone either crashes/undergoes wear and tear/becomes damaged; leading to the purchase of a new drone (due to high costs for repair/replacement of parts);</p>	<p><i>Award [1] for each of three distinct points in an explanation of two ways that drones can become obsolete up to [3 max].</i></p> <p><i>Mark as [3] + [3].</i></p>	6

Question		Answers	Notes	Total
7.	d	<p>Comfort: anthropometric/ergonomic data can be used in the design of the handset; to fit a range of hand sizes; minimising fatigue/strain;</p> <p>Safety: the handset should be ergonomically designed; to prevent injury being sustained to the hand/thumb/fingers; due to continual use of the handset controllers;</p> <p>the drone's footage is viewable on the handset (in real time); enabling the user to view the surrounding area; avoiding any hazards/possible obstructions/accidents;</p> <p>Performance: biomechanics of the hands can be analysed; enabling the designer to consider the reach/force/pressure needed; to operate the controls of the handset efficiently;</p>	<p><i>Award [1] for each of three distinct points of how the study of human factors can be used to improve the comfort of the handset that controls the drone up to [3 max].</i></p> <p><i>Award [1] for each of three distinct points of how the study of human factors can be used to improve the safety of the handset that controls the drone up to [3 max].</i></p> <p><i>Do not award marks across clusters under safety.</i></p> <p><i>Award [1] for each of three distinct points of how the study of human factors can be used to improve performance of the handset that controls the drone up to [3 max].</i></p> <p><i>Mark as [3] + [3] + [3].</i></p>	9