Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2016

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 tick (✓) 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 size ✓ finger/thumb dimensions ✓	*Award **[1]** for stating one piece of anthropometric data important to the design of the carton.*	**1 max**
		ii	provides grip ✓ making it easier to pick up ✓ easy to open ✓ flap provides larger contact surface between user's fingers ✓ sealing/joining the carton ✓ to provide surface area for adhesion ✓	*Award **[1]** for identifying one reason for the design of the Tetra Pak carton with a flap at the top of the Tetra Pak carton **[1]** for a brief explanation.*	**2 max**
	b	i	barrier/protection ✓ prevents flavour loss/entry of oxygen/light/moisture/ bacteria/extends life of contents ✓ rigidity ✓ the pack can stand upright/be easily handled ✓	*Award **[1]** for identifying one advantage of the multiple layer construction of the carton and **[1]** for a brief explanation.*	**2 max**
		ii	to protect the Tetra Pak brand ✓ by restricting other companies/people from using it ✓ represents the company ✓ distinguishes from the company's product ✓	*Award **[1]** for identifying one reason why Tetra Pak company uses a Trade Mark (™) symbol on its cartons and **[1]** for a brief explanation.*	**2 max**

	c	**i**	choice/utilisation of materials ✓ that provides greater recycling potential ✓ choice of joining method/adhesives ✓ for ease of recycling ✓ design for disassembly ✓ which aids in the separation of layers	*Award **[1]** for identifying one method Tetra Pak can use to increase the recyclability of its cartons and **[1]** for a brief explanation.*	**2 max**
		ii	cartons are lighter in weight/packed more efficiently than glass ✓ making them easier to transport ✓ reducing cost/energy/environmental impact ✓ glass bottles are brittle/carton is more tough ✓ glass is more prone to breakage ✓ which could cause wastage/injury ✓ single use only ✓ so not required to be sterilized ✓ therefore costs may be reduced ✓ has a larger surface area than on bottles ✓ more information can be included on the carton ✓ which may open up a new promotional/marketing opportunities ✓	*Award **[1]** for each of three distinct points in an explanation of one advantage of the Tetra Pak carton over the glass/metal containers.*	**3 max**

	d	**i**	$\frac{43 \text{ billion} \times 100}{24.5}$ ✓= 175.5 billion ✓ accept any rounded figure between 175 500 000 000 and 175 510 204 081	*Award **[1]** for the workings.* *Award **[1]** for the correct answer.* *If the answer includes the word 'billion' the numerical figure must be to at least one decimal point.*	**2**
		ii	paperboard cartons are less likely to be reused unlike glass ✓ creating more waste ✓ recycling/recyclability ✓ cartons made of multiple layers of different materials/joined using adhesives are more difficult to separate for recycling purposes ✓ cartons are not transparent, unlike glass ✓ consumers are unable to see the contents inside ✓	*Award **[1]** for identifying one disadvantage of cartons compared to glass containers and **[1]** for a brief explanation of that disadvantage.*	**2 max**
	e	**i**	reduction in material usage ✓ may affect level of functionality of the carton ✓	*Award **[1]** for identifying one implication of dematerialisation for the design of Tetra Pak carton and **[1]** for a brief explanation.*	**2**
		ii	may lead to deforestation ✓ due to increased use of timber for cardboard production ✓ pollution caused by the use of non-renewable energy ✓ during processing of aluminium/plastics/cardboard to produce the carton ✓ increased landfill/waste ✓ as cartons are produced in large quantities/are not widely recycled ✓	*Award **[1]** for identifying one effect on the environment of the production of cardboard cartons and **[1]** for a brief explanation of its advantage to the environment.*	**2 max**

Question			Answers	Notes	Total
2	a		F= T/d = 6.3 Nm/0.0315m ***OR*** $F = \frac{T}{d} = \frac{6.3}{0.0315}\text{N}$ ✓ 200 N ✓	*Award **[1]** for the workings.* *Award **[1]** for the correct answer.* *Correct answer must show the unit N.*	**2 max**
	b		comfort ✓ textured grip creates ease-of-use when opening/closing the screw cap ✓ effort/torque/force required to open the cap ✓ to allow a wide range of users ✓	*Award **[1]** for identifying one physiological factor related to the design of the screw cap and **[1]** for a brief explanation.*	**2 max**
3			LCA is costly/time consuming ✓ It requires complex specialist knowledge on the product life cycle stages ✓ which small companies may not have the human resources/technology to implement ✓ small companies 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 each of three distinct points in an explanation of one disadvantage to the user with a physical disability.*	**3 max**
4			biodegradable plastics are made to break down more quickly/easily ✓ thus reducing the environmental impact/landfill/waste of the plastic material ✓ promotes sustainability/circular economy in the development of new plastic material ✓	*Award **[1]** for each of three distinct points in a discussion of the implications of biodegradability in the development of new plastic material.*	**3**

Section B

Question			Answers	Notes	Total
5	a		to increase durability ✓ wax resists moisture which would cause deterioration of the cords/prevents wear/fraying ✓ ease-of-manufacture ✓ a waxed cord is easier to feed through the wooden frame ✓ comfort ✓ reduces friction from the clothing of the person sitting on the chair ✓ smooth texture ✓ makes it easier to clean ✓	*Award **[1]** for identifying one reason why the textile cords are treated with wax and **[1]** for a brief explanation.*	**2 max**
	b		fibres are a raw textile material which lack strength/are not easy to use in manufacturing ✓ fibres are twisted to form a yarn/thicker cord which enhance tensile strength ✓ making the yarn easier to manipulate/use in manufacturing ✓	*Award **[1]** for each of three distinct points in an explanation of why it is necessary for the textile fibres to be formed into a yarn to create the cords of the Woven Easy Chair**.***	**3**
	c		*Function:* the ash hardwood provides a strong frame ✓ wide/thick/solid base provides stability/balance ✓ which should consider ergonomic data ✓ technique used to join the woven cord to wooden frame provides strength to the chair ✓ which should provide flexibility/support to the user ✓ **[3 max]** *Form:* the chair has a solid frame but the woven cord makes the form less bulky/less solid ✓ the shape creates a striking visual balance/sculptural form/decorative effect ✓ the form is angular/geometrical ✓ aesthetics are enhanced/contrasted by use of different materials ✓ **[3 max]**	*Award **[1]** for each of six distinct points in a discussion of the design of the Woven Easy Chair in relation to the balance between form and function **[3 max for each]**.*	**6 max**

Question			Answers	Notes	Total
	d		*Production costs:* production costs would most likely increase ✓ creating a woven structure from multiple cords increases the time of manufacture/labour cost/amount of material used ✓ errors may occur in the attachment of the individual cords, which may require more work ✓ **[3 max]** *Ease of maintenance:* ease of maintenance is most likely enhanced ✓ if individual cords fail they can be replaced more quickly than one single cord ✓ this can be done more easily, *ie*, without special skills/training of the users ✓ extending product life ✓ **[3 max]** *Durability:* durability may decrease ✓ as the multiple cords are more likely to fail/slacken ✓ causing them to come off the fixing points over time ✓ dependant on how the chair is used ✓ **[3 max]**	*Award **[1]** for each of the three distinct points of making the incremental change to a design that uses multiple cords instead of single cords with respect to production costs, ease of maintenance and durability. **[3max]** for production costs, **[3max]** for ease of maintenance and **[3max]** for durability. **[3 max for each]**.*	**9 max**

Question			Answers	Notes	Total
6	a	i	aesthetics ✓	*Award **[1]** for stating an advantage of using paint to finish the parts of the Playshapes product.*	**1**
		ii	can wear off ✓ hides the grain ✓ potentially toxic ✓ increase production cost/product cost ✓	*Award **[1]** for stating a disadvantage of using paint to finish the parts of the Playshapes product.*	**1 max**
	b		close-grained/few knots ✓ appropriate for cutting out curved shapes/less likely to splinter ✓ has a smooth surface suitable for painting /produces a safer product ✓ durability and hardness ✓ resistant to impact/scratching during use ✓ leading to a long lasting product ✓ density/weight ✓ enhances stability ✓ when pieces are stacked on top of each other ✓	*Award **[1]** for each of three distinct points in an explanation of a characteristic of hardwood timber which is important for the nature of the Playshapes design.*	**3 max**

	c		*CAD modelling:* CAD modelling is good for gaining feedback from target market/audience regarding ideas for shapes/graphics ✓ design are easier to manipulate in CAD based on feedback ✓ CAD could be used with CAM to quickly produce prototypes ✓ CAD files can be easily shared with other people in other locations ✓ **[3 max]** *Physical modelling:* physical modelling is suitable for trialling with children to see how easy/challenging the product will be to use ✓ physical modelling is suitable to gain feedback on ergonomics, *ie* sizes, texture from observing children with the product ✓ physical modelling provides feedback regarding safety by observing how children handle the pieces/see if they try to put pieces in their mouth ✓ performance testing can be useful to determine durability/finish ✓ **[3 max]**	*Award **[1]** for each of six distinct points in an explanation of two advantages of combining computer aided design (CAD) modelling with physical modelling to gain feedback during the design development of the PlayShapes product. **[3 max for each]**.*	**6 max**

	d		*Relative Advantage:* advantageous in relation to the various configurations which can be achieved ✓ enhances/encourages individual and group play/use in different contexts ✓ parents see enjoyment/educational value of toy through child's use/interaction with the product ✓ use of hardwood rather than plastic ✓ so parents who purchase the product feel it is of higher quality ✓ would be seen as better value for money ✓ suitable for a range of ages and abilities ✓ the product would be used for a longer period of time ✓ would be seen as better value for money ✓ **[3 max]** *Observability:* the more the advantages/positive effects of PlayShapes are observed by the target market/audience ✓ the more quickly they will spread ✓ the observability of PlayShapes is limited to childcare/organisations/nurseries/homes/promotional campaigns/social media ✓ **[3 max]** *Complexity:* complex products are usually seen as a negative aspect of adoption especially for this target audience ✓ the product is very simple in relation to concept/construction ✓ but complex/challenging enough for young children of different ages/abilities to use ✓ **[3 max]**	*Award **[1]** for each of three distinct points in an explanation of relative advantage, observability and complexity in relation to anticipated consumer adoption of the Playshapes product. **[3max]** for relative advantage, **[3max]** for observability and **[3max]** for complexity **[3 max for each]**.*	**9 max**

Question			Answers	Notes	Total
7	a		the technology push comes from the development of smart devices (phones/apps/computer/watch) ✓ sensors and USB in the racquet link the performance of the user to a computer/smart phone to provide feedback ✓	*Award **[1]** for identifying the influence of technology push and **[1]** for a brief explanation.*	**2 max**
	b		technological obsolescence ✓ as the existing technology is made redundant by new/emerging technologies ✓ such as software and electronics ✓ functional obsolescence ✓ due to the sensitive electronic components ✓ which may become damaged with continual use ✓ fashion obsolescence ✓ products with embedded technology may be seen as a trend/fad ✓ which lasts for a short/unknown period of time ✓	*Award **[1]** for each of three distinct points in an explanation of why the product life of the Play Pure Drive tennis racquet is likely to be shorter than a conventional tennis racquet.*	**3 max**
	c		*Biomechanics:* the data provides the designer with information transmitted from the racquet whilst in use ✓ providing better analysis and understanding of a player's movements/skill ✓ based on strength/performance of age/gender groups/torque (*eg* power/strokes/impact location/physical ability) ✓ **[3 max]** *Ongoing development:* key mechanical characteristics of a stroke are analysed ✓ which leads to improvements of racquet design/strings/head shape ✓ to reduce the risk of injury/enhance performance ✓ **[3 max]**	*Award **[1]** for each of six distinct points in an explanation of how the data collected by the Play Pure Drive racquet contributes to a designer's understanding of biomechanics and the ongoing development of the racquet **[3 max for each]**.*	**6 max**

	d		*Percentile ranges:* a percentile range is the proportion of a population with a dimension at or less than a given value ✓ there is a wide target market for the Play Pure Drive racquet encompassing age/gender/race ✓ hand sizes vary within the target market ✓ percentile ranges are used to decide the range of sizes to offer consumers so they can choose the one that best fit them ✓ the correct percentile range must accommodate the technology embedded in the handle ✓ **[3max]** *Static data:* static data is anthropometric data collected when the user is still (not moving) ✓ static data would be gathered regarding hand size/grip ✓ using both primary and secondary anthropometric data via user trials/user research/measuring users ✓ **[3 max]** *Dynamic data:* dynamic data relates to how users perform in action (moving) with the tennis racquet ✓ dynamic data on user's strokes/movements informs the design of software/electronics ✓ so that the design is able to recognise the strokes played by users and provide feedback ✓ **[3max]**	*Award **[1]** for each of three distinct points in an explanation of the use of percentile ranges, static and dynamic data to the design of the Play Pure Drive tennis racquet. **[3 max]** for percentile range, **[3 max]** for static data and **[3 max]** for dynamic data **[3 max for each]**.*	**9 max**