M11/4/DESTE/SP2/ENG/TZ0/XX/M

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MARKSCHEME

May 2011

DESIGN TECHNOLOGY

Standard Level

Paper 2

14 pages

If you do not have a copy of the current Design Technology Guide, please request one from IB Cardiff.

General Marking Instructions

Assistant Examiners (AEs) will be contacted by their team leader (TL) by e-mail (or telephone) – if by e-mail, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this initial contact is to allow AEs to raise any queries they have regarding the markscheme and its interpretation. AEs should contact their team leader by e-mail at any time if they have any problems/queries during the marking process.

Note:

The DHL courier service must be used to send assessment material to your team leader/senior moderator and to IB Cardiff. (However, this service is not available in every country.) The cost is met directly by the IB. It is vitally important that the correct DHL account number is used.

If you have any queries on **administration** please contact:

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1. Follow the markscheme provided, award only whole marks and mark only in **RED**.

2. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**

3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking. It should be remembered that the script may be returned to the candidate.

4. Unexplained symbols or personal codes/notations are unacceptable.

5. Record marks in the right-hand margin. For Section A this should be against each mark allocation shown in square brackets *e.g.* ***[2]***. The total mark for a question must equal the number of ticks for the question.

6. Do **not** circle sub-totals. **Circle the total mark** for the question in the right-hand margin **at the end of the question.**

7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin next to the square bracket.

8. Where work is submitted on additional sheets the marks awarded should be shown as ticks and a note made on both the additional sheet and in the right-hand margin of the corresponding question part in the body of the script to transfer these marks to that question part in the script.

9. Section A: Add together the total for each question and write it in the Examiner column on the cover sheet.
Section B: Insert the total for each question in the Examiner column on the cover sheet.
Total: Add up the marks awarded and enter this in the box marked TOTAL in the Examiner column on the cover sheet.

10. After entering the marks on the cover sheet check your addition to ensure that you have not made an error. Check also that you have transferred the marks correctly to the cover sheet. **All scripts are checked and a note of all clerical errors will be given in feedback to examiners.**

11. If an answer extends over more than one page and no marks have been awarded on a section draw a diagonal line through that section to indicate that it has been marked.

12. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers and use the marks of those answers that have the highest mark, **even if the candidate has indicated the question(s) to be marked on the cover sheet**.

13. A mark should not be awarded where there is contradiction within an answer. Make a comment to this effect in the left-hand margin.

Subject Details: Design Technology SL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A (total 20 marks) **ONE** question in Section B [20 marks]. Maximum total = 40 marks.

1. A markscheme often has more marking points than the total allows. This is intentional. Do **not** award more than the maximum marks allowed for part of a question.

2. Each marking point has a separate line and the end is signified by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/) – either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. 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 markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by writing ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. 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. Indicate this with **ECF** (error carried forward).

10. Only consider units at the end of a calculation. Unless directed otherwise in the markscheme, unit errors should only be penalized once in the paper. Indicate this by writing **–1(U)** at the first point it occurs and **U** on the cover page.

11. Do not penalise candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

SECTION A

1. (a) (i) *Award **[1]** for stating the number of pairs of sliding doors on each car.*
8; ***[1]***

(ii) *Award **[1]** for stating the total number of seated passengers which the car can carry.*
$8+10+12+10+8=48$; ***[1]***

(iii) *Award **[1]** for identifying one advantage of the folding seats shown in section A of the car in Figure 3 and **[1]** for a brief explanation **[2 max]**.*
can accommodate wheelchair users / provides space for luggage;
seats fold out of way to provide more room;

enables more flexible use of the car;
tube trains can get very busy at peak times; ***[2 max]***

(b) (i) *Award **[1]** for stating one reason why bright colours are used for the handrails.*
aesthetics;
increased visibility;
ease of maintenance; ***[1 max]***

(ii) *Award **[1]** for each distinct correct point in an explanation of how the tubular sections for the handrails would have been produced **[3 max]**.*
extrusion of long tubular sections of steel;
cut to appropriate lengths;
finish to required colour with appropriate finish, *e.g.* heavy duty paint; ***[3 max]***

(c) (i) *Award **[1]** for identifying the adult percentile which would have been used to determine the height for the hanging handholds and **[1]** for a brief explanation **[2 max]**.*
5^{th} percentile (female) vertical reach;
so that most adults would be able to reach the handhold; ***[2]***

(ii) *Award **[1]** for each point in an outline of one advantage of using the vertical handrail shown in Figure 5 over the hanging handholds **[2 max]**.*
people can stand next to vertical rails or hold onto overhead rails;
accommodates a wider range of passengers *e.g.* wheelchair users, children, very short people, *etc.* ***[2 max]***

2. (a) *Award **[1]** for a definition of thermal expansion to the effect of:*
a measure of the degree of increase in dimensions/expansion of material/elongation of material when an object is heated; ***[1]***

(b) *Award **[1]** for each of three distinct correct points in an explanation of one reason why the expansion joint shown in Figure 6 is an important consideration in the design of the bridge **[3 max]**.*
in hot and cold weather a bridge would expand and contract;
if the expansion joint were not there then the expansion would cause the bridge to crack;
this would make the bridge unsafe; ***[3]***

3. (a) *Award **[1]** for a definition of assembly-line production to the effect of:*
the mass production of a product via a flow line based on the interchangeability of parts, pre-processing of materials, standardization and work division; ***[1]***

(b) *Award **[1]** for each of three distinct correct points in an explanation of the impact of assembly-line production on the workforce for a mechanized production process **[3 max]**.*
job specialization;
a worker would do one job repetitively;
this would be monotonous and worker might get bored;

the assembly-line runs continuously;
this means that workers have to remain at station;
they are not free to move around, *e.g.* to go to the toilet;

repeating the same movements for hours can lead to repetitive strain injury;
this may lead to increased levels of sickness absence;
need to consider occupational safety;

assembly line can be very noisy;
this means that the workers will have to wear ear protection;
they will not be able to converse normally with their colleagues;

job creation;
mechanized assembly lines require many people;
who do not need expensive training; ***[3 max]***

SECTION B

4. (a) (i) *Award **[1]** for each of two advantages of using polypropene to make the seat of the chair **[2 max]**.*
cheap;
durable;
lightweight;
non-absorbing surface/liquids do not soak in;
resistant to dirt;
easy to clean;
can be recycled;
suitable for injection moulding/low melting point;
little need for finishing;
available in a range of colours;
flexes for comfort;
toughness;
tensile strength; ***[2 max]***

(ii) *Award **[1]** for each of two distinct correct points in a description of how production of the chair in a range of sizes is an example of product development **[2 max]**.*
variations to the product through variations in the sizes/colours makes it suitable for use for children of different sizes/ages in schools;
the robust design of the Robin Day chair thus becomes the basis for a family of products; ***[2]***

(b) (i) *Award **[1]** for each of two distinct correct points in a description of the concept of break-even in relation to the manufacture of the chair **[2 max]**.*
fixed costs are divided by a break-even number determined by the chair manufacturer;
this portion of the fixed costs is added to the variable costs of manufacturing each chair;

at break-even point fixed costs are covered;
further sales means a profit can be made; ***[2 max]***

(ii) *Award **[1]** for each of three distinct points in an explanation of one way in which injection moulding contributes to cost-effectiveness for the chair manufacturer in relation to the manufacture of the chair in a range of sizes **[3 max]**.*
moulds for the range of chair sizes are expensive to produce;
one mould needed for each chair size but each mould can produce a very large number of chairs;
one injection moulding machine can accommodate moulds of various sizes so different machines are not needed;

fixed costs high;
variable costs low;
quickly reach break-even for each size in the range then maximise profit;

injection moulding is a rapid process;
with very little waste;
and good quality control; ***[3 max]***

(c) (i) *Award **[1]** for identifying how percentile range data for school children would contribute to the design of the different chair sizes and **[1]** for a brief explanation **[2 max]**.*
the chair is made in different sizes to respond to different age groups/sizes of children;
the 50^{th} percentile for each age group would be used to determine the seat height and width of the chair; ***[2 max]***

(ii) *Award **[1]** for each of three distinct correct points in an explanation of how design for materials, process and assembly are dominating constraints on the design of the chair **[3 max]** per strategy **[9 max]**.*

Design for materials:
material properties have to be taken into account in the design of the product, *e.g.* strength, stiffness, melting point;
the designer tries to use materials with the optimum required properties;
but matched to the manufacturing process/cost;
so does not have to invest in new machinery/tooling;

Design for process:
manufacturer need designs to be produced using equipment available;
to reduce the fixed costs of the process;
process determines a number of aspects of the design;

injection moulding requires material flow in the mould;
if the chair/mould were not appropriately designed for material flow then a lot of manufacturing errors would occur;
this would push up manufacturing costs;

Design for assembly:
reducing the number of parts makes the product easier to assemble;
making the chair so that it can be assembled from one direction;
makes it easier for assembly-line production;

designing so only correct assembly is possible;
useful, especially when semi-skilled labour or user assembly is used;
also when safety issues would result from incorrect assembly;

consideration of the joining of the product is important in relation to design for assembly;
permanent joining or temporary joining can be considered;
temporary joining, *e.g.* by use of snap fittings can be cheap and easy;

design for assembly requires communication between designer and the manufacturing team;
ensures all aspects of the assembly of the product are considered in the design;
ensures design can be manufactured cost-effectively; ***[9 max]***

5. (a) (i) *Award **[1]** for identifying a target market for the Balanzza Digital Luggage Scale and **[1]** for a brief explanation **[2 max]**.*
frequent travellers, especially ones who travel on different airlines;
they can keep a check on the weight of their luggage and avoid penalties;

families who travel together;
they can use the Balanzza to distribute their luggage and minimize penalties incurred; ***[2 max]***

(ii) *Award **[1]** for each of three distinct correct points in an explanation of why the price of the final product would be a major constraint in the design brief **[3 max]**.*
the product is about saving money;
the price has to be less than/about the same as the cost of the penalties on first usage so that is represents value for money to the consumer;
if it costs more than the penalties it would not achieve its goal; ***[3 max]***

(b) (i) *Award **[1]** for each point in an outline of one difficulty the manufacturers of the Balanzza Digital Luggage Scale would have in getting their product to diffuse into the marketplace **[2 max]**.*
it is a novel product;
there is no/low awareness of the product in the marketplace;

many people do not fly often enough to justify the purchase;
if flying occasionally they can use other scales so no need for the Balanzza;

there are no competing products;
have to develop awareness of the product from scratch so people become interested in it and want one;

promotion;
people need to be persuaded of the benefit of owning the product; ***[2 max]***

(ii) *Award **[1]** for each point in an outline of one strategy involving the Internet that the manufacturers of the Balanzza Digital Luggage Scale could use to enhance market penetration **[2 max]**.*
banner ad on website *e.g.* ticketing website/airline website;
to promote/advertise the product;

use of social networking sites / virtual travel communities;
these enable travellers to share good ideas / problems encountered with travel and other products; ***[2 max]***

(c) (i) *Award **[1]** for each of two ergonomic considerations which would inform the design of the Balanzza Digital Luggage Scale **[2 max]**.*
size of font on digital readout;
shape of body of luggage scale and recesses for fingers;
ease of opening and closing clip to secure strap to luggage;
position/size of buttons;
ease of grip;
handwidth;
finger width;
volume of beep sound; ***[2 max]***

(ii) *Award **[1]** for each of three distinct correct points in an discussion of each of three evaluation activities (tests, models and experiments) that would be used to evaluate ideas for the Balanzza Digital Luggage Scale at the "developing the chosen solution" stage of the design cycle **[3 max]** per strategy **[9 max]**.*
prototype of luggage scale;
gain feedback from users/experts;
check suitability for manufacturing;

user trial;
to develop shape of thermoplastic body of digital scale;
positioning of fingergrips to ensure comfort in use for range of users (range of hand sizes);

materials tests for body/strap materials;
ensure product meets specification;
identification of maximum weight that the scale can withstand;

tests re. accuracy of digital readout of luggage weight;
using different test weights and taking repeat readings;
statistical analysis of accuracy and precision of digital read-out;

performance test;
to test how robust the casing is;
as the scale will be dropped on the floor sometimes; ***[9 max]***

6. (a) (i) *Award **[1]** for stating one way in which constructive discontent might inform the development of Le Toaster Vision and **[1]** for a brief explanation **[2 max]**.*
identify "good" and "bad" aspects of the design of current models;
ensure that the new model resolves bad aspects and equals or exceeds performance relating to good aspects;

discontent with non-transparent models;
design the transparent model so the user can see the extent of browning/have more control; ***[2 max]***

(ii) *Award **[1]** for each of three distinct correct points in a explanation of the benefit of adopting a pioneering strategy for the Magimix company in relation to the production of Le Toaster Vision **[3 max]**.*
first to market;
greatest profit potential;
helps establish corporate reputation for company as being innovative; ***[3]***

(b) (i) *Award **[1]** for identifying one physical property of glass, apart from its transparency, which makes it suitable for the walls of the Le Toaster Vision and **[1]** for a brief explanation **[2 max]**.*
low thermal conductivity;
so case of product should not become dangerously hot during use;

coefficient of thermal expansion of the glass can be designed to match that of the metal case;
ensure no damage as product becomes hot during use;

hard;
will not scratch easily; ***[2 max]***

(ii) *Award **[1]** for stating one reason why design for disassembly is an important consideration for Le Toaster Vision and **[1]** for a brief explanation **[2 max]**.*
toaster is made of different materials/components;
these need to be separated at the end of the product life to facilitate recycling/enable the toaster to be repaired/enable parts to be separated for reuse; ***[2 max]***

(c) (i) *Award **[1]** for stating one way in which planned obsolescence would influence the design specification of Le Toaster Vision and **[1]** for a brief explanation **[2 max]**.*
planned obsolescence will match guarantee period;
the manufacturer needs to select materials carefully to ensure they meet the specification;

the toaster is designed to be made from a variety of parts;
it is likely that the heating tubes will fail first; ***[2]***

(ii) *Award **[1]** for each of three distinct correct points in a discussion of the criteria that a consumer might apply to evaluate Le Toaster Vision for value for money before purchase, during initial use and after long-term use **[3 max]** per reason **[9 max]**.*
Before purchase:
company website / virtual consumer groups / expert appraisal;
provide detailed product specification/product comparisons;
can compare list price with specification and determine value for money;

advertising;
promote aesthetics / product image / benefits of product ownership;
does the image match person's self-perception;

During initial use:
ease of use;
performance;
safety issues;
e.g. evenness of toasting / time to toast;

Long-term use:
reliability;
the product may be unreliable;
the consumer may prefer to replace if product unreliable;

ease of maintenance;
the product may need a lot of maintenance;
e.g. fiddly maintenance / regular cleaning;

durability;
the product may not last for long and need to be replaced;
it may begin to look unattractive if finish does not last;

running costs;
the product may be expensive to run;
the consumer may prefer to replace if product is too expensive to run; ***[9 max]***