M12/4/DESTE/HP2/ENG/TZ0/XX/M

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MARKSCHEME

May 2012

DESIGN TECHNOLOGY

Higher 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 HL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A (total 40 marks) **ONE** question in Section B [20 marks]. Maximum total = 60 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 which component of the SEARASER acts in the same way as the plastic football.*
upper float; ***[1]***

(ii) *Award **[1]** for stating the purpose of the automatic adjustment of the column.*
changes the height of the SEARASER /in relation to the size of the waves/water depth; ***[1]***

(iii) *Award **[1]** for one limitation of the SEARASER in relation to safety and **[1]** for a brief explanation **[2 max]**.*
may become untethered/it sits just beneath the surface of the water/can be difficult to see;
a danger to boats/swimmers/a collision hazard; ***[2]***

(b) (i) *Award **[1]** for the type of evaluation strategy used for the first prototype and **[1]** for a brief explanation **[2 max]**.*
performance test;
to test the rate at which water is pumped/whether it works; ***[2]***

(ii) *Award **[1]** for the evaluation strategy used for the second prototype and **[1]** for a brief explanation **[2 max]**.*
field trial;
the prototype was tested in the type of location it is to be used in; ***[2]***

(c) (i) *Award **[1]** for stating the idea generating technique which acted as a stimulus for the inventor.*
adaptation; ***[1]***

(ii) *Award **[1]** for each distinct correct point in a discussion of the stage of the innovation cycle currently reached by the SEARASER **[3 max]**.*
early stage/it is still a prototype;
no diffusion in to the marketplace;
it cannot be considered an innovation; ***[3]***

(d) (i) *Award **[1]** for calculating how many litres of water the second prototype pumped ashore in the month of April of the test.*
112800 × 30 = 3384000 litres ***[1]***

(ii) *Award **[1]** for each stage in the calculation of the number of large-scale SEARASER pumps needed to power 1000 homes if they operate at 50% efficiency **[3 max]**.*
22369/2 (50%) = 11184.5kWh/day, 11184.5/47 = 238 houses;
1000/238 = 4.2 pumps;
5 pumps needed per 1000 homes; ***[3]***

(e) (i) *Award **[1]** for each stage in the calculation of how many days one SEARASER would need to operate at maximum efficiency to provide 1000 kW of electricity **[2 max]**.*
1000 kW/22.369kWh = 44.7h;
44.7/24 = 1.86 days *i.e.* 2 days; ***[2]***

(ii) *Award **[1]** for one reason why the SEARASER is unlikely to operate at maximum efficiency each day and **[1]** for a brief explanation **[2 max]**.*
some days the sea could be calm;
so not enough waves to produce the energy;

maintenance/wear and tear;
the pump may become corroded/clogged/break down; ***[2 max]***

2. (a) *Award **[1]** for stating the primary energy source which powered the Industrial Revolution.*
coal; ***[1]***

(b) *Award **[1]** for each distinct correct point in an explanation of one disadvantage of the continued development of biomass as a fuel source **[3 max]**.*
biomass energy is derived from plant matter;
which contains carbon;
burning of this fuel pollutes the atmosphere;

expense;
collection/harvesting/distribution;
needs to be processed into a useable form;

if it is used for large scale development;
impact on crop development for food;
because of the amount of land used to grow the fuel crops; ***[3 max]***

3. (a) *Award **[1]** for each distinct correct point in a description of how the design of an I-shaped beam makes effective and economical use of materials **[2 max]**.*
the horizontal sections of the beam (flanges) are wide to spread the force of the load;
the vertical section of the beam (web) is narrow to reduce the amount of material that is used;
(*a suitable annotated diagram is acceptable*) ***[2]***

(b) *Award **[1]** for one benefit of using a LVL beam in the construction industry and **[1]** for a brief explanation **[2 max]**.*
cost effective;
LVL beams are cheaper to use than solid wood beams;

size;
LVL beams can be manufactured to desired lengths;

can be built in situ;
easier to lift into place;

stability;
less likely to warp/twist/bow/shrink than solid wood beams;

can be manufactured in a curved shape;
but with a straight grain; ***[2 max]***

4. (a) *Award **[1]** for a definition of Young's modulus to the effect of:*
a measure of the stiffness of a material/relationship between stress and strain; ***[1]***

(b) *Award **[1]** for each distinct correct point in an explanation of how knowledge of the Young's modulus of a material affects the selection of materials for a tennis racquet **[3 max]**.*
material has to be stiff enough so that it does not deflect/flex too much on impact with the tennis ball;
but not so stiff that the material cannot absorb some of the impact force of the ball;
if this performance characteristic is not achieved to optimum level, it would affect the quality of the strokes /cause potential injury; ***[3 max]***

5. (a) *Award **[1]** for each of two moulding techniques used to manufacture plastic bottles **[2 max]**.*
injection moulding;
blow moulding; ***[2]***

(b) *Award **[1]** for the relevance of the draft angle in the creation of a mould for vacuum forming and **[1]** for a brief explanation **[2 max]**.*
draft angle is a taper (5–7 degrees);
which is necessary to be able to easily remove the plastic object from the mould when formed; ***[2]***

6. (a) *Award **[1]** for a definition of intelligent building to the effect of:*
a building which has many features controlled by technological devices in order to improve the interior environment/function; ***[1]***

(b) *Award **[1]** for each distinct correct point in a discussion of grey water in relation to conservation of resources in a domestic building **[3 max]**.*
grey water is generated from processes such as washing;
it can be processed/treated to use it as clean water/re-used where clean water is not required;
and hence reduce the amount of water used in the building which conserves resources; ***[3]***

SECTION B

7. (a) (i) *Award **[1]** for one ergonomic feature of the Viber Burst in relation to safety and **[1]** for a brief explanation **[2 max]**.*
rounded corners/no sharp edges/comfortable to hold;
no snagging on clothes/cannot cause damage in pockets/handbag; ***[2]***

(ii) *Award **[1]** for each point in an outline of why the charger can be considered a combination of radical and incremental design and **[1]** for a brief explanation **[2 max]**.*
incremental because it is a further development of an existing product;
radical in the way it charges a mobile phone; ***[2]***

(b) (i) *Award **[1]** for a green design objective satisfied by the charger and **[1]** for a brief explanation **[2 max]**.*
long product life cycle/no need to replace it often;
minimizes pollution/waste/use of resources;

recyclable;
made from a thermoplastic material;

uses renewable energy;
no atmospheric pollution/carbon emissions; ***[2]***

(ii) *Award **[1]** for each distinct correct point in a suggestion of a manufacturing technique for the production of the plastic body of the charger **[3 max]**.*
injection moulding;
suitable for thermoplastics;
most cost-effective solution for the shape; ***[3]***

(c) (i) *Award **[1]** for a reason why the charger may be considered part of a product family and **[1]** for a brief explanation **[2 max]**.*
different designs are available;
to provide more choice to consumers; ***[2]***

(ii) *Award **[1]** for each distinct correct point in an explanation of how market penetration, market development and product development contribute to a hybrid corporate strategy for innovation of the charger **[3 max]** per reason.*
Market penetration:
Charger is aimed at existing customers who purchase chargers;
Persuading them of the benefits of this product compared to others on the market;
Especially in relation to environmental concerns;

Market development:
The charger is a new application for an existing product;
With the continued popularity of mobile phones there is an increasing market for chargers;
The aesthetics of the design is aimed at young consumers;

Product development:
The product uses an existing technology *i.e.* kinetic energy;
To create a new type of product;
Which is a combination of technology push and market pull/new product design for a market which demands innovation; ***[9]***

8. (a) (i) *Award **[1]** for each of two physical properties which are important in the selection of material for the bike frame **[2 max]**.*
hardness (high);
density (low); ***[2]***

(ii) *Award **[1]** for each of two distinct points in a description of the matrix composition of a composite **[2 max]**.*
fibres are interlocked/woven together;
bonded with a resin; ***[2]***

(b) (i) *Award **[1]** for one security issue relating to the bike and **[1]** for a brief explanation **[2 max]**.*
bike is more appealing for thieves;
needs to be locked securely when not in use/expensive product/many features which would make it easy to sell on; ***[2]***

(ii) *Award **[1]** for each distinct correct point in an explanation of the benefit of "extra torque" being provided by the electric motor **[3 max]**.*
torque is a rotational force;
the rotational force on the rear wheel is converted into linear motion;
more torque results in increased velocity/extra power to climb hills; ***[3]***

(c) (i) *Award **[1]** for identifying one safety issue relating to the bike for other road users and **[1]** for a brief explanation **[2 max]**.*
the bike looks like an ordinary bike;
other road users may not take into account the bike's speed on hills/the extra power it has;

the bike can be used with or without power assistance;
other road users may find the bike unpredictable in relation to speed and so how to make room for it; ***[2 max]***

(ii) *Award **[1]** for each of three distinct points of explanation of the relationship of each of strength, stiffness and factor of safety to the design of the bicycle **[3 max]** per aspect.*

Strength:
the frame and drive mechanisms need to be very strong;
in order to resist the load of the rider;
and other external loads *e.g.* storage items/muscle power;

Stiffness:
the frame needs to be very stiff;
so that it does not deflect under the external loads;
or the vibration caused by riding over rough terrain;

Factor of safety:
the factor of safety needs to be high enough to ensure that the bike can withstand loads higher than normally expected;
but if the factor of safety is too high then the bike may be too heavy;
and lose the benefit of its strength to weight ratio; ***[9]***

9. (a) (i) *Award **[1]** for identifying why the silver pencil may be considered a green product **[2 max]**.*
the lead can be replaced;
so the pencil does not need to be discarded causing waste/pollution;

silver can be economically recycled/melted down to create a new product;
which minimizes use of resources/energy; ***[2 max]***

(ii) *Award **[1]** for identifying one quality assurance feature of the silver pen and **[1]** for a brief explanation **[2 max]**.*
hallmark;
shows that the casing is made from solid silver/with a high silver content/ is internationally recognised; ***[2]***

(b) (i) *Award **[1]** for identifying a reason why wood was chosen as an appropriate material for the pencil in the eighteenth century and **[1]** for a brief explanation **[2 max]**.*
availability of timber;
low cost;

easy to work with timber/most products were made from timber;
experience and skills used for other products;

durability;
protects the brittle graphite;

sharpening the pencil;
easy to remove layers to expose the graphite by traditional means/ shaving timber; ***[2 max]***

(ii) *Award **[1]** for each of three distinct points in an explanation of one reason for the choice of glue for the wooden pencil **[3 max]**.*
epoxy resin is very strong;
is appropriate to bond together dissimilar materials (such as the wood and the graphite);
and is quick drying so cost-effective for manufacturing; ***[3]***

(c) (i) *Award **[1]** for identifying why the wooden pencil may be considered an example of robust design and **[1]** for a brief explanation **[2 max]**.*
the wooden pencil has been manufactured and sold for many centuries worldwide;
and still has a huge market today;

the concept of the wooden pencil has been adapted into a range of products;
expanding the market to other areas of application; ***[2 max]***

(ii) *Award **[1]** for identifying an aspect on which to compare **[1]** for a point relating to the wooden pencil and **[1]** for a point relating to the silver pencil in relation to value for money for the consumer in each case **[3 max]** per aspect.*

cost;
in 1761 the wooden pencil was a very expensive product affordable by wealthy people;
today the modern silver pencil is also expensive and is aimed at the high end of the market;

status;
in 1761 owning a wooden pencil conveyed status on the user;
today the silver pencil does the same because of the use of precious metal rather than novelty value;

competition;
in 1761 there was no alternative type of pencil to the wooden pencil;
there are many choices for consumers today so deciding to purchase the silver pencil is a sign that the consumer thinks the price is worth paying;

materials;
in 1761 graphite was rare and expensive;
silver is a precious metal which means a high price for silver products;

craftsmanship;
the wooden pencil was expensive to produce in 1761 with human skill;
the silver pencil will be machine manufactured but still gives the impression of being hand crafted;

aesthetics;
the 1761 wooden pencil was a new type of product with aesthetic appeal;
the silver pencil is manufactured to make the most of the aesthetic appeal of the silver material; ***[9 max]***