Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2015

Design technology

Higher level

Paper 2

13 pages

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

2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.

3. 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.**

4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use RM™ Assessor annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.

5. Personal codes/notations are unacceptable.

6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, use the "ZERO" annotation to award zero marks. Where a candidate has not attempted the part question, use the "SEEN" annotation to show you have looked at the question. RM™ Assessor will apply "NR" once you click complete.

7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers RM™ Assessor will only award the highest mark or marks in line with the rubric.

8. Ensure that you have viewed **every** page including any additional sheets. Please ensure that you stamp "SEEN" on any additional pages that are blank or where the candidate has crossed out his/her work.

9. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the "CON" stamp.

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.

2. Each marking point has a separate line and the end is shown 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 ***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. When marking indicate this by adding **ECF** (error carried forward) on the script.

10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

Section A

1. (a) (i) *Award **[1]** for stating one reason why consumers may purchase a Bboxx system rather than an oil-powered system. **[1 max]**.*
More environmentally friendly;
If able to gain reliable solar energy it will be a cheaper option;
oil prices fluctuate so may be much more expensive in future;
oil has to be collected from a retailer/delivered so not convenient;
availability of oil; **[1 max]**

(ii) *Award **[1]** for stating the data from Table 1 most likely to be affected by long-term use of the control unit.*
84 Wh of stored energy;
95% charging efficiency; **[1]**

(iii) *Award **[1]** for each distinct correct point in a description of why the drop test for the control unit is from a 60 cm height.*
60 cm is approx. the height from the ground at which the unit would be carried around / placed on a worksurface;
the test therefore replicates the most likely way in which it would be accidently dropped; **[2]**

(b) (i) *Award **[1]** for identifying one advantage and **[1]** for a brief explanation **[2 max]**.*
promotes consumer confidence;
a consumer has a means of redress if the product does not work; **[2]**

(ii) *Award **[1]** for a design feature of the control unit which takes into account the apparent conflict for the temperature data outlined in (b) (i) and **[1]** for a brief explanation.*
there is thermal overload protection;
so if the temperature is too high the unit will cut out to protect it; **[2]**

(c) (i) *Award **[1]** for stating one disadvantage of charging the battery from the national grid rather than from the solar panel. **[1 max]**.*
it will cost more to run the system as solar energy is free;
lack of portability;
environmental damage as the electricity from the grid is likely to be generated from fossil fuels; **[1 max]**

(ii) *Award **[1]** for each distinct correct point in a suggestion of one reason why the Bboxx system may be considered an appropriate technology. **[3 max]**.*
Bboxx work with local partners;
so able to draw upon local knowledge/cultural influences;
the system can be adapted to suit local needs;

appropriate to the local context;
where no national grid is available;
allows for the use of electrical products; **[3 max]**

Do not accept generic statements like "good for the environment".

(d) (i) *Award **[1]** for stating the type of evaluation strategy that relates to the hail impact test.*
performance test; **[1]**

(ii) *Award **[1]** for each distinct correct point in a discussion of one potential limitation of the hail impact test in relation to anticipated conditions of use for the solar panel. **[3 max]**.*
the test assumes all hailstones have the same size / shape and impact on contact;
if the panel was used during an actual hailstorm then many hailstones would hit the panel almost simultaneously;
so the effect on the panel could be very different to that from the lab test;

the environment in which the panel will be used may not suffer from hailstorms;
so the test is not valid/important/relevant;
except that it shows the panel is able to withstand a certain amount of impact such as from falling branches/fruit/nuts *etc*. **[3 max]**

(e) (i) *Award **[1]** for why the solar panel could be used in more global locations than the control unit and **[1]** for a brief explanation.*
the solar panel can be used in temperatures ranging from $-40^{\circ}\text{C} - 85^{\circ}\text{C}$ so it can be used virtually anywhere in the world;
but the control unit's range of $20^{\circ}\text{C} - 25^{\circ}\text{C}$ means it is only suitable for areas with a hot climate; **[2]**

(ii) *Award **[1]** for why the solar panel is designed to be flexible and **[1]** for a brief explanation.*
the system is portable so it may be moved around a great deal;
the flexibility of the panel absorbs shock so minimizing damage; **[2]**

2. (a) *Award **[1]** for stating one reason why coal is a relatively cheap fuel source for many industrialized countries. **[1 max]**.*
large amounts available in different global locations / abundant;
competitive market keeps the price low; **[1]**

(b) *Award **[1]** for each distinct correct point in a discussion of whether clean coal technology eliminates the environmental impact of the use of coal as a major fuel source in industry.*
the technology principally focuses on capturing carbon dioxide emissions from burning coal and solidifying them into a liquid;
disposal of the liquid carbon dioxide safely is an environmental issue and there are other pollutant emissions from burning coal;
clean coal technology is not a solution to the problems caused by burning coal but an improvement; **[3]**

3. (a) *Award **[1]** for each distinct correct point in a description of how the structure of LVL timber makes it a suitable choice of material for roof beams spanning a roof 25 m long.*
LVL beams are made from layers of timber glued together under great pressure;
so they can be manufactured to any length without compromising strength; **[2]**

(b) *Award **[1]** for each distinct correct point in a description of why LVL beams are often made to resemble beams made from solid natural timber. **[2 max]**.*
LVL beams are often clad/covered with thin layers of natural timber;
so they look like one solid beam made from the timber cladding/covering;

aesthetics so they match the look of other timber in the context;
as the beams can be clad with different types of timber so increasing consumer choice;
[2 max]

4. (a) *Award **[1]** for stating the type of load created by the mass of the structure in **Figure 2**.*
body; **[1]**

(b) *Award **[1]** for each distinct correct point in an explanation of why the structure in **Figure 2** is in equilibrium.*
the tensile and compressive forces are balanced;
they are equal in size;
and opposite in direction; **[3]**

5. (a) *Award **[1]** for one way in which it is easy for users to overload the machine shown in Figure 3 when using it to abrade a piece of timber and **[1]** for a brief explanation.*
if users apply too large a load/press too heavily on the belt sander;
the belt will cease to move/the motor may be damaged; **[2]**

(b) *Award **[1]** for each distinct correct point in a description of why belt sander machines may be considered low maintenance.*
they are simple machines;
worn/damaged belts are easy to replace; **[2]**

6. (a) *Award **[1]** for stating one key feature of a living building in relation to water usage. **[1 max]**.*
harvest own water needs on site/recycles waste water;
minimizes waste; **[1 max]**

(b) *Award **[1]** for each distinct correct point in a discussion of why the symbolic terms of "grey water" and "black water" are often used in relation to conservation of water resources.*
grey water refers to water which has been lightly contaminated such as bathing water which is not safe to drink but can be recycled for use where the level of contamination will not have a detrimental effect *eg* flushing toilets;
black water is heavily contaminated and should not be recycled;
the terms used are easy to understand for consumers with white or clear water at one extreme, black at the other extreme and grey somewhere in the middle; **[3]**

Section B

7. (a) (i) *Award **[1]** for each distinct correct point in a description of the structure of timber as a natural composite material.*
composed of cellulose fibres;
in a lignin matrix; **[2]**

(ii) *Award **[1]** for each distinct correct point in a description of how the design of the bamboo keyboard is seen as a combination of radical and incremental design.*
radical in the use of wood as the majority of keyboards are plastic;
incremental in other aspects as similar to existing designs; **[2]**

(b) (i) *Award **[1]** for which category of Design for Manufacture (DfM) was a dominating constraint on the design brief for the keyboard and mouse and **[1]** for a brief explanation.*
Design for Materials;
because the key selling point of the product is that it is made from wood; **[2]**

(ii) *Award **[1]** for each distinct correct point in an evaluation of the bamboo keyboard in relation to ease of maintenance.*
the keyboard will be easy to wipe clean as long as the gloss finish does not deteriorate;
which will happen with a great deal of use/over time;
and a new finish will be difficult to apply because of the numerous individual parts; **[3]**

(c) (i) *Award **[1]** for stating what is meant by "the bamboo timber coming from a sustainable resource" and **[1]** for a brief explanation.*
the rate of bamboo growth is greater than the rate of harvesting;
so there is no depletion of bamboo as a natural resource / little impact on environment; **[2]**

(ii) *Award **[1]** for each distinct correct point in a discussion of three potential target markets for the bamboo keyboard and mouse. Award **[3 max]** per target market.*
domestic market/for use in the home;
people who want the products to blend in with wooden furniture;
and prefer handcrafted products;

users who appreciate the aesthetic characteristics of natural wood;
such as grain patter/colour;
and the traditional image portrayed;

ecofans;
consumers who buy environmentally friendly products;
as a moral/social responsibility;

consumers who enjoy unusual/quirky products;
and may see the keyboard/mouse as a conversation piece;
but still functional; **[9]**

8. (a) (i) *Award **[1]** for each distinct correct point in a description of how plastic deformation contributes to the manufacture of the chair in **Figure 6**.*
***[2 max]**.*
when the plastic is heated for moulding it undergoes plastic deformation to take the shape of the mould;
this is irreversible so when the plastic cools it retains the shape; **[2 max]**

(ii) *Award **[1]** for each distinct correct point in a description of how elastic deformation contributes to the performance of the chair in **Figure 6**.*
in use the plastic undergoes elastic deformation from the load/forces applied by the user;
this means that the chair back provides comfort by having a certain amount of flexibility but when the load is released it returns to its original shape; **[2]**

(b) (i) *Award **[1]** for one reason why the chair in **Figure 6** was expensive to purchase in 1968 even though it is a simple structure made from a single sheet of plastic and **[1]** for a brief explanation. **[2 max]**.*
because the design is so simple the quality of the surface finish is very important and any flaws/blemishes will be very apparent and spoil the look of the chair;
the manufacturing process is technically complex and it is likely that quality control would have been difficult in order to ensure perfect ones for sale;

R & D and design costs would have been high;
due to the radical use of a new material and manufacturing process;

the scale of production would have been limited as it was a unique/novelty product;
so little economies of scale to minimize the price; **[2 max]**

(ii) *Award **[1]** for each distinct correct point in a discussion of the surface finish of the chair in **Figure 6** in relation to comfort. **[3 max]**.*
the high gloss finish provides a smooth surface which is comfortable to sit on;
but the surface is also hard;
which will not be comfortable for sitting for long periods;
the high gloss finish is smooth and comfortable for short periods,
but could also be slippy if the user is wearing shiny/smooth clothing;
and trap moisture which will lead to discomfort; **[3 max]**

(c) (i) *Award **[1]** for stating the manufacturing technique for the chair in **Figure 6** and **[1]** for a brief explanation.*
vacuum forming;
the sheet of plastic is heated in a machine/vacuum former which sucks out the air so the soft plastic adheres to the shape of the mould when pressed against it and is released when cooled; **[2]**

(ii) *Award **[1]** for each distinct correct point in a discussion of three ways in which the designer of the chair in **Figure 6** has attempted to balance form with function. Award **[3 max]** for each way.*
sculptural form of the chair gives a striking appearance;
but it also has to work as a suitable structure for sitting on;
so the designer has had to carefully balance the need of function without compromising the form;

the designer has had to take into account ergonomic considerations;
such as anthropometric data relating to the seat height *etc;*
and also comfort in relation to the shape/form;

the designer has had to balance the forces/loads acting on the structure when used for sitting;
in order to achieve a stable structure;
but this is not obvious from looking at the form;

using a single sheet of plastic to mould into the form is technically very difficult;
especially when attempting to satisfy structural requirements;
but it accentuates the flowing form of the chair;

plastic is a good material to use to create a curved/flowing structure;
which allows support for the back of the user;
and the edges provide structural strength/rigidity; **[9 max]**

9. (a) (i) *Award **[1]** for one potential limitation of the use of the Bladefish for observing underwater wildlife and **[1]** for a brief explanation.*
noise/vibration from the motor;
could disturb/frighten fish away;

30 m depth limit;
Interesting wildlife could be located at greater depths; **[2]**

(ii) *Award **[1]** for one potential limitation of the Bladefish for use on holiday when travelling by air and **[1]** for a brief explanation.*
weight;
4.4 kg is quite heavy and may mean luggage is over the weight limit/causes an excess baggage charge by the airline;

size;
it is quite large to fit into standard luggage/might not be enough room for it; **[2 max]**

(b) (i) *Award **[1]** for one disadvantage of the Bladefish in relation to green design and **[1]** for a brief explanation.*
use of batteries (lithium);
these can cause environmental damage on disposal; **[2]**

(ii) *Award **[1]** for each distinct correct point in a discussion of the design of the Bladefish in relation to maintenance.*
it will need to be cleaned regularly as underwater/in the sea algae/seaweed *etc* could clog the mechanism;
and sea water is very corrosive;
the battery will need replacing at regular intervals as it will lose its ability to maintain a decent charge;
there are moving parts which would require frequent lubrication / servicing; **[3]**

(c) (i) *Award **[1]** for one limitation of the Bladefish when used by a family on holiday and **[1]** for a brief explanation.*
it can only be used for 40 minutes before re-charging which takes an hour;
a re-charging facility needs to be readily available if it is to be used by a number of people which may not be feasible on the beach;

family may be made up of different ages / physical sizes / abilities in the water;
some family members may not have the right attributes to use the Bladefish appropriately / safely / successfully; **[2]**

(ii) *Award **[1]** for each distinct correct point in a discussion of three potential safety issues for the use of the Bladefish. Award **[3 max]** per issue.*
it may be dropped by the user when underwater;
although the maximum depth of use is 30 m it may lie in much deeper water;
the untrained diver/user may be tempted to dive to deeper water to retrieve it;

inexperienced users may be carried an unsafe distance from the shore;
as considerable distance can be covered in 40 minutes at 4.25 k/h;
and when the Bladefish runs out of power the user may be stranded;

inexperienced users may be tempted to explore areas they would not normally go to;
such as underwater caves;
and may get lost/disorientated;

careless use of the Bladefish underwater could cause damage;
to sensitive coral reefs/wildlife;
eg small fish could swim through the guard into the blades/impact damage;

users may be so absorbed using the Bladefish at a depth of 30 m;
they are oblivious to changing weather conditions on the surface;
and cannot get back to shore safely at the end of the dive;

the Bladefish may malfunction/break down during a dive;
the user may not have the strength to carry it back to shore;
and get carried away by the current;

the guard may become damaged/loose;
exposing the sharp blades;
and potentially causing injury to users; **[9 max]**