N10/4/DESTE/HP2/ENG/TZ0/XX/M

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MARKSCHEME

November 2010

DESIGN TECHNOLOGY

Higher Level

Paper 2

16 pages

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 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 to show that these marks have been transferred to the appropriate square bracket in the body of the script.

9. Section A: Add together the total for each question and write it in the Examiner column on the front cover.
Section B: Insert the total for each question in the Examiner column on the front cover.
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 front cover 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 front cover**.

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 identifying that four 1200 mm lengths and three 800mm lengths of 145 mm wide 22 mm thick wood pieces are required to construct the EPAL pallet and **[1]** for calculating the total length.*
$(4\times1200)+(3\times800)$ mm pieces;
7200 mm total length; ***[2]***

(ii) *Award **[1]** for identifying one reason why products must not project beyond the edges of the pallet and **[1]** for a brief explanation.*
to avoid being damaged during transport in factory and outside;
if they are within the footprint of the pallet they will be protected;

safe storage;
so the pallets can be stored easily/compactly without gaps between them; ***[2 max]***

(b) (i) *Award **[1]** for stating one advantage of the pallets being made of wood.*
easily repaired;
wood cushions/absorbs any impacts and prevents potential damage to products on the pallets;
availability, timber is a global resource;
tough/durable; ***[1 max]***

(ii) *Award **[1]** for identifying one advantage of the design of the EPAL pallet enabling the pallet to be lifted from each of its sides and **[1]** for a brief explanation.*
makes it easier to handle the pallets wherever they are in the factory/ storage facility;
they can be lifted on the narrower edge or the wider edge depending on where they are;
lifting by the narrower edge should allow the pallets to be carried through narrow doorways and into narrow storage spaces;
more efficient storage/predictable storage arrangement; ***[2 max]***

(c) (i) *Award **[1]** for stating an advantage of the pallets being labelled with the EPAL logo and **[1]** for a brief explanation.*
ease of recognition;
ensures appropriate pallet truck used for handling pallets;

shows that it meets standard specification;
good for legislative/health and safety purposes; ***[2 max]***

(ii) *Award **[1]** for each distinct correct point in an explanation of the need for global standards for pallet sizes.*
products are traded internationally;
to load in one country and unload in another requires the pallet sizes to be standardized;
different pallet sizes need different equipment to lift them;
this would push up costs and time required for handling;
pallet truck needs to be correct size to handle pallets safely;
using wrong sizes may lead to accidents;
products may be damaged if mishandled;
so they fit the pallet/fork lift trucks when they go elsewhere; ***[3 max]***

(d) (i) *Award **[1]** for identifying why Cudzik's design is an example of constructive discontent and **[1]** for a brief explanation.*
Cudzik identified a problem with the previous design
which gave him the impetus to produce a new design; ***[2]***

(ii) *Award **[1]** for an advantage of the stay-on ring pull end over the earlier design, apart from it not being able to be thrown away as litter or swallowed and **[1]** for a brief explanation.*
maximises material for recycling;
ring pull material will be recycled at the same time as the rest of the can;

no sharp edges;
unlikely to cause cuts/bleeding; ***[2 max]***

(e) (i) *Award **[1]** for stating the correct class of lever that Cudzik's ring-pull is*
first class lever; ***[1]***

(ii) *Award **[1]** for each distinct correct point in an explanation of one ergonomic consideration in the design of the lever.*
size of the lever;
relative to the size of the finger;
people with large fingers must not find it too fiddly to open;

force to be applied to lift the ring pull;
the mechanical advantage of the lever;
the effort required to operate the lever and open the can must not exceed the effort that can be exerted by even the weakest finger;

shape of the ring-pull;
oval shape;
makes it easier to lift up;

the space between the ring-pull and the lid of the can;
must be large enough to enable a person to put their finger-nail under the ring-pull to lift it;
if it is too small it will be difficult to open the can; ***[3 max]***

2. (a) *Award **[1]** for stating one psychological factor related to the ergonomics of a design.*
taste;
texture;
light;
smell;
sound;
temperature; ***[1 max]***

(b) *Award **[1]** for each of three distinct correct points in a discussion of the influence of perception when collecting data relating to psychological factors.*
different people perceive things in different ways;
what might be acceptable/pleasant for one person may be unacceptable/ unpleasant for another;
it is difficult to convert perceptions into quantitative data in a meaningful way to allow comparison; ***[3]***

3. (a) *Award **[1]** for identifying one impact of automation on working conditions and **[1]** for a brief explanation.*
nature of employment;
looking after machines rather than craft or mechanised production needs a different skill set;

health and safety issues;
there are likely to be fewer accidents than when using mechanised or craft production;

social interaction;
there are fewer people so less social interaction potentially;

job satisfaction;
this may increase or decrease – depends on person; ***[2 max]***

(b) *Award **[1]** for a way in which automation has improved the type and range of products available to consumers and **[1]** for a brief explanation.*
price accessibility of products;
some products can only be made cheaply enough if they are made by automation;

precision;
some products can only be made precisely enough if made by automation;

consumer choice;
automation means a wider variety of products can be produced cost-effectively;

mass customization;
automation allows consumers to customize a product without the cost of craft production; ***[2 max]***

4. (a) *Award **[1]** for stating one advantage of developing a freehand drawing for use with consumers.*
easy to understand/visualize for non-specialists;
quick to draw;
easily amended;
can be annotated to explain the thinking behind the design concept;
enables the designer to consider the implications of the concept; ***[1 max]***

(b) *Award **[1]** for each of three distinct points in an explanation of why a designer would produce both an orthographic drawing and an isometric drawing.*
they would be used at different stages of the design cycle and for different purposes;
the isometric drawing shows the shape and form of the design in 3–D;
the orthographic drawing shows the detail of the design in 2–D including measurements and would be used as production drawings; ***[3]***

5. (a) *Award **[1]** for stating which stage of the product cycle that the laptop computer is in.*
mature; ***[1]***

(b) *Award **[1]** for each of three distinct points in an explanation of a strategy that designers could use to extend the product life of a personal computer.*
replacement/upgrading of components;
additional memory/faster CPU;
some parts, *e.g.* case / screen, do not need upgrading;

repairability;
ensuring that the various components can be replaced easily;
using standard components that are easily sourced;

no planned obsolescence;
design and manufacture the product to last a long time;

quality;
ensure materials and manufacturing processes provide a good quality product; ***[3 max]***

6. (a) *Award **[1]** for a definition of design for process to the effect of:*
designing to enable the product to be manufactured using a specific manufacturing process, *e.g.* injection moulding; ***[1]***

(b) *Award **[1]** for each of three distinct correct points in an explanation of one way in which design for process can contribute to a green design strategy.*
a product can be designed to use a particular process, *e.g.* injection moulding;
injection moulding uses less energy/reduces waste/reduces pollution/non-toxic materials;
due to use of low melting point thermoplastics/only material used in the product is melted/material can be easily recycled;

optimum use of resources;
designer ensures that the product can be manufactured in the most cost-effective way;
thereby minimising waste/energy use; ***[3 max]***

SECTION B

7. (a) (i) *Award **[1]** for a definition of daylighting to the effect of:*
windows/other transparent media/reflective material so that natural daylight provides sufficient illumination; ***[1]***

(ii) *Award **[1]** for identifying a way in which the use of glass blocks in the construction of the shower screen contribute to daylighting and **[1]** for a brief explanation.*

transparent;
allows light to get into shower area; ***[2]***

(iii) *Award **[1]** for identifying one way in which daylighting contributes to reduced energy consumption in buildings and **[1]** for a brief explanation.*
no need for artificial light;
therefore reduced energy consumption;

sunlight also creates heat;
so contributes to heat gain of a building; ***[2 max]***

(b) (i) *Award **[1]** for each of two criteria for the selection of the adhesive to join the blocks together to form the shower screen.*
waterproof;
sealant;
aesthetic properties/colour/texture;
ease of maintenance/cleaning; ***[2 max]***

(ii) *Award **[1]** for identifying one disadvantage of using an adhesive to join the blocks to form the shower screen and **[1]** for a brief explanation.*
permanent joining technique;
does not enable the screen to be disassembled easily to reuse the blocks/ replace one if it is damaged;

difficult to keep clean/bacteria (mould) free;
so can be unsightly;

aesthetics;
breaks up the appearance of the glass wall;

possibility of decay/cracking;
requiring maintenance/causes leaks; ***[2 max]***

(c) (i) *Award **[1]** for identifying one disadvantage of using glass as a structural material and **[1]** for a brief explanation.*
a safety hazard if damaged;
can cause cuts/bleeding;

weak in tension;
so can only be used in compression; ***[2 max]***

(ii) *Award **[1]** for each of three distinct correct points in an explanation of three reasons, apart from its transparency, why glass is increasingly used as a structural material.*
appropriate for open-plan offices;
but also provided sound proofing;
and visual links between separate spaces;

it has a smooth surface;
thus it is resistant to dirt;
easy to keep clean;

tough;
resistant to cracks;
good material for use as tiles for walls or floors;

low thermal conductivity;
can be used for insulation;
reduce energy costs for buildings;

good for passive solar collection;
contributes well to the heat gain of a building;
helps to reduce energy costs of operating building;

available in large sheet sizes;
with different properties;
so offers flexibility of design;

image;
large glass buildings stand out in the urban landscape;
as sun is reflected from the different surfaces;

sustainable resource;
recyclable;
glass panels can be easily replaced; ***[9 max]***

8. (a) (i) *Award **[1]** for stating one advantage of laminating timber.*
strong curved shapes;
can use smaller pieces of timber to produce larger pieces than could be obtained from natural timber;
cheaper than natural timber;
good strength to weight ratio;
can be manufactured with different surface veneers; ***[1 max]***

(ii) *Award **[1]** for each distinct correct point in a description of how lamination contributes to the strength of the beam shown in Figure 9.*
composite material (wood/glue) stronger;
the glue helps to distribute the forces through the beam; ***[2]***

(iii) *Award **[1]** for each of two distinct points in a description of how LVL differs from plywood.*
all grain runs in same direction in LVL;
the grain is at right angles in plywood; ***[2]***

(b) (i) *Award **[1]** for each distinct correct point in a description of how the shape of the sectional members of a structure makes the most effective and economic use of materials*
the lamination process is designed to suit the shape of the beam;
to reduce waste/use minimum amount of material;

if the beam was made from solid timber;
it would create a great deal of waste material; ***[2]***

(ii) *Award **[1]** for each of two distinct correct points in a description of the importance of a factor of safety in the design of beams.*
adding a factor of safety means that the design load is bigger than the expected load;
to ensure future unexpected loads can be withstood/the structure remains safe even if defects occur in the material; ***[2]***

(c) (i) *Award **[1]** for identifying one benefit of using LVL beams in the construction industry.*
cheaper;
natural timber of similar size often much more expensive;

stronger;
natural timber can have faults in it which can weaken it;

can get larger sizes than can get from natural timber;
longer/larger beams for larger internal spans;

can be built up in situ;
this reduces the need for heavy lifting; ***[2 max]***

(ii) *Award **[1]** for each distinct correct point in a discussion of three issues relating to the consideration of timber as a sustainable resource.*
time to reach maturity;
softwood trees reasonably fast growing (less than one human life time) and therefore can be regarded as a renewable resource;
hardwood trees are slow growing (more than one human life time) and therefore cannot be regarded as a renewable resource;

soil erosion;
deforestation can lead to soil erosion;
this makes the deforested area incapable of supporting the growth of other crops;
it also makes the area susceptible to flooding;

greenhouse effect;
deforestation reduces carbon fixation;
this means that atmospheric carbon dioxide levels will rise;
this leads to global warming and climate change;

extinction of species;
deforestation can lead to the extinction of tree species;
it also removes the habitat of other species/birds/insects
monoculture of just one species reduces biodiversity; ***[9 max]***

9. (a) (i) *Award **[1]** for a definition of field trial to the effect of:*
testing of the performance of a new product under the conditions in which it will be used; ***[1]***

(ii) *Award **[1]** for a reason why it would be important to conduct a field trial before embarking on the construction of a large solar project and **[1]** for a brief explanation.*
to ensure that the units are robust enough for the climatic conditions to which they will be exposed;
any modifications to the design can be made before an enormous number of units are produced;

gain feedback;
in relation to the scope/scale of the design;

test the design in situ;
to consider re-design possibilities; ***[2]***

(iii) *Award **[1]** for a reason why solar power can be regarded as a clean technology and **[1]** for a brief explanation.*
no pollution/carbon emissions;
therefore no contribution to global warming/climate change; ***[2]***

(b) (i) *Award **[1]** for identifying how the Bellagio principles would help in relation to the evaluation of the proposal for a solar project and **[1]** for a brief explanation.*
the Bellagio principles are designed to enable the evaluation of the sustainability of a proposed development;
their use allows for different aspects of sustainability to be considered; ***[2]***

(ii) *Award **[1]** for a reason why the cost per Watt is a more important consideration in evaluating a solar project than the overall efficiency of energy conversion and **[1]** for a brief explanation.*

the cost per Watt will determine the economic viability of the proposal;
this is likely to be a major factor in determining whether the solar project is developed;
the cost per Watt must be equal to/less than other production methods;
otherwise the electricity from the solar project will not be competitive/successful; ***[2 max]***

(c) (i) *Award **[1]** for identifying one disadvantage of solar power and **[1]** for a brief explanation.*

high set up costs;
production of panels/setting up solar farm;

lack of continuity of supply;
poor weather, *e.g.* in winter;

high maintenance requirements;
the photovoltaic cells need to be kept clean; ***[2 max]***

(ii) *Award **[1]** for identifying how life cycle analysis would be used at each of three different stages in the life cycle of the units for a solar project and **[1]** for each of two additional points of explanation **[3 max]** per stage.*
At the preproduction stage;
to specify materials which are recycled or can be recycled;
to design the units for production, use and disassembly;
to design the units so they use the least amount of raw material;

At the production stage;
to ensure that the units are produced in the least environmentally damaging way;
to ensure that least pollution is caused;
to ensure the most effective use of materials;
to minimise pollution in the manufacture of the units;

At the distribution stage;
to minimise packaging for the units on their journey from factory to installation site;
to minimise energy requirements in distribution, *e.g.* boat not plane;
lightweighting of units so that minimum weight for transportation;
optimise design so maximise units per load;
locate factory as close as possible to the installation site;

At the utilization stage;
to ensure that the units can be cost-effectively maintained;
to ensure that the units can be repaired;
to ensure that the units have a reasonable product life;

At the disposal stage;
to ensure that the materials/components comprising the unit can be reused or recycled;
to ensure that the materials are not toxic;
to ensure that the units can be disassembled; ***[9 max]***