IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

N04/4/DESTE/HP2/ENG/TZ0/XX/M

MARKSCHEME

November 2004

DESIGN TECHNOLOGY

Higher Level

Paper 2

13 pages

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

General Marking Instructions

After marking a sufficient number of scripts to become familiar with the markscheme and candidates' responses to all or the majority of questions, Assistant Examiners (AEs) will be contacted by their Team Leader (TL) by telephone. The purpose of this contact is to discuss the standard of marking, the interpretation of the markscheme and any difficulties with particular questions. It may be necessary to review your initial marking after contacting your TL. **DO NOT BEGIN THE FINAL MARKING OF YOUR SCRIPTS IN RED INK UNTIL YOU RECEIVE NOTIFICATION THAT THE MARKSCHEME IS FINALISED.** *You will be informed by e-mail, fax or post of modifications to the markscheme and should receive these about one week after the date of the examination. If you have not received them within 10 days you should contact your Team Leader by telephone. Make an allowance for any difference in time zone before calling.* **AEs WHO DO NOT COMPLY WITH THESE INSTRUCTIONS MAY NOT BE INVITED TO MARK IN FUTURE SESSIONS.**

1. Follow the markscheme provided, do **not** use decimals or fractions and mark only in **RED**.

2. Where a mark is awarded, a tick (✓) should be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark.

3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation in the **left hand margin** to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking.

4. Unexplained symbols or personal codes/notations on their own are unacceptable.

5. Record subtotals (where applicable) in the right-hand margin against the part of the answer to which they refer (next to the mark allocation for Section A). Do **not** circle sub-totals. **Circle the total mark for the question in the right-hand margin opposite the last line of the answer.**

6. For Section B, show a mark for each part question (a), (b), *etc*.

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

8. 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 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.

9. 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. **We have script checking and a note of all clerical errors may be given in feedback to examiners.**

10. Every page and every question must have an indication that you have marked it. Do this by **writing your initials** on each page where you have made no other mark.

11. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark only the required number of questions in the order in which they are presented in the paper, unless the candidate has indicated the question(s) s/he wants to be marked on the cover sheet.

12. A candidate can be penalized if he/she clearly contradicts him/herself 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.

General

A markscheme often has more specific points worthy of a mark than the total allows (especially for essay questions). This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).
- An alternative answer or wording is indicated in the markscheme by a '/'; either wording can be accepted.
- Words in (…) in the markscheme are not necessary to gain the mark.
- The order of points does not have to be as written (unless stated otherwise).
- If the candidate's answer has the same 'meaning' or can be clearly interpreted as being the same as that in the mark scheme then award the mark.
- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have not achieved or what they have got wrong.
- Remember that many candidates are writing in a second language; be forgiving of minor linguistic slips. Effective communication is more important than grammatical niceties.
- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalised. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with **'ECF'**, error carried forward.
- Units should always be given where appropriate. Omission of units should only be penalised once. Indicate this by **'U-1'** at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.
- 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:*
$75 \times 64 = 4\,800$ m OR 4.8 km; ***[1 max]***

(ii) *Award **[1]** for each step as shown:*
wheel turns through 90°;
424/4 = 106 m;
106 m / 0.26 m/s = 407.7 s / 6m 47.7 s *i.e.* 7 m to nearest minute; ***[3 max]***

(b) (i) *Award **[1]** for stating an appropriate reason **[1 max]**.*
tensile forces keep the structure is in equilibrium; ***[1 max]***

(ii) *Award **[1]** for each distinct point in an appropriate explanation **[3 max]**.*
strong enough to support the body load of the structure;
the external load of the people;
stiff enough not to buckle; ***[3 max]***

(c) (i) *Award **[1]** for*
aesthetics;
safety;
cost; ***[1 max]***

(ii) *Award **[1]** for each distinct point in an appropriate explanation, **[2 max]**.*
interactive;
likely to be attractive to a large number of people;
prime location;
so easily accessible;
highly visible;
large scale;
so dominates the landscape and is highly visible; ***[2 max]***

(d) (i) *Award **[1]** for*
1; ***[1 max]***

(ii) *Award **[1]** for one advantage and **[1]** for a brief explanation **[2 max]**.*
cleaning;
maintenance staff can go into the capsule to clean it between A and B;
visual checks for any damage;
so it can be left empty at B if appropriate; ***[2 max]***

(iii) *Award **[1]** for each reason from the following list, **[2 max]**.*
time for doors to open/close;
time for children in pushchairs / elderly people to board;
safety margin to allow for unforeseen problems; ***[2 max]***

(e) *Award **[1]** for each distinct point in an appropriate explanation, **[3 max]**.*
safety;
wheelchairs have limited maneuverability;
they take longer to board and leave the capsules; ***[3 max]***

2. (a) *Award **[1]** for a definition to the effect of*
the ability to analyse information in order to select an answer from alternatives; ***[1 max]***

(b) *Award **[1]** for each distinct point in an appropriate explanation **[3 max]**.*
a PDS defines the precise limits for the complete range of performance requirements;
research is required to develop the brief and identify appropriate limits for each performance requirement;
research will involve data collection and analysis through use of convergent thinking to set limits; ***[3 max]***

3. (a) *Award **[1]** for a definition to the effect of*
an approach to manufacturing that uses less resources and causes less environmental damage than an alternative approach with this it is economically competitive; ***[1 max]***

(b) *Award **[1]** for each distinct point in an appropriate explanation **[3 max]**.*
designers need scientific knowledge of the effects of manufacturing systems on the environment;
designers need scientific knowledge of manufacturing systems in order to use them appropriately for product manufacture;
scientific knowledge provides quantitative data to monitor the impact of clean technology on the environment to ensure pollution is being reduced; ***[3 max]***

4. (a) *Award **[1]** for each correct response from the list below **[1 max]***
particle board (chipboard);
plywood;
blockboard;
medium density fibreboard (MDF);
laminboard; ***[1 max]***

(b) *Award **[1]** for each distinct point in an appropriate explanation **[3 max]**.*
fasteners and/or dowel joints are not as durable as traditional jointing with solid timber;
composite timber is usually finished with a thin veneer of wood or plastic which when damaged exposes the ugly core of the composite, so the furniture is discarded rather than repaired;
furniture from composite timber is cheaper than natural timber furniture and so had lower exchange value; ***[3 max]***

5. (a) *Award **[1]** for each of two responses from the list below **[2 max]***
low fat / cholesterol;
high protein;
low salt;
high fibre; ***[2 max]***

(b) *Award **[1]** for each distinct point in an appropriate explanation **[2 max]**.*
it provides a high protein food;
so it is an alternative to mass production of animal protein;
it can be coloured, shaped and flavoured to resemble many types of meat products;
and so is an alternative to eating meat; ***[2 max]***

6. (a) *Award **[1]** for each of two strategies from the following list **[2 max]**;*
observing user behaviour;
collecting user responses;
[2 max]

(b) *Award **[1]** for a limitation and **[1]** for a brief explanation **[2 max]**.*
for functional dimensions;
it is difficult to collect accurate reliable dynamic data;
some ergonomic data is qualitative rather than quantitative;
e.g. for comfort or fatigue; ***[2 max]***

SECTION B

7. (a) (i) *Award **[1]** for any appropriate response from the list below, **[1 max]**.*
stiffness;
toughness;
tensile strength;
ductility; ***[1 max]***

(ii) *Award **[1]** for each distinct point in a brief description, **[2 max]**;*
the iron in the steel oxidises when exposed to oxygen and water;
steel needs a protective coating to prevent the oxidation; ***[2 max]***

(iii) *Award **[1]** for identifying a suitable treatment and **[1]** for a brief explanation **[2 max]**.*
paint;
can be used to protect the steel and to give the lamp a particular colour;
chrome;
protect the steel and give the lamp an attractive shiny or matt finish;
enamelling;
protects the steel with a rust proof coating in a range of hardwearing colours and textures; ***[2 max]***

(b) (i) *Award **[1]** for each appropriate characteristic from the list below that makes glass an appropriate material for the reflector;*
transparent;
aesthetically good;
unaffected by the heat of the bulb;
easy to form and shape; ***[2 max]***

(ii) *Award **[1]** for an appropriate feature and **[1]** for a brief explanation.*
the use of a low wattage bulb;
saves energy; ***[2 max]***

(c) (i) *Award **[1]** for identifying a design stage at which orthographic drawings would be relevant and **[1]** for a brief explanation, **[2 max]**.*
planning and realizing the chosen solution;
the orthographic drawing shows details and dimensions and can be used as a production drawing; ***[2 max]***

(ii) *Award **[1]** for identifying each of three ways in which the designer has balanced form and function and **[1]** per distinct point in an explanation, **[3 max]** per way, **[9 max total]**.*
the structure must be in equilibrium;
the two beams are counterbalanced by the weights at each end;
the counterbalancing weights are an integral part of the design; ***[3 max]***

the function accentuates the form as a piece of sculpture;
how the lamp functions is not obvious by looking at it;
adjustability is gained by the pivots; ***[3 max]***

the cables are secreted inside the metal tubes;
they do not then interrupt the form;
the appearance accentuates the impression of a piece of sculpture rather than a functional object; ***[3 max]***

the form is minimalist;
it uses the minimum amount of materials;
there is no added decoration – all surfaces are unembellished; ***[3 max]***

the transformer is also the base;
the transformer will be a heavier component;
using it as the base gives the lamp stability; ***[3 max]***

[9 max total]

8. (a) (i) *Award **[1]** per distinct point in a description of the structure of wood **[2 max]**.*
cellulose fibres;
in a lignin matrix; ***[2 max]***

(ii) *Award **[1]** per appropriate characteristic from the list below, **[2 max]**.*
grow only in temperate climates;
coniferous;
fast growing; ***[2 max]***

(b) (i) *Award **[1]** for stating a benefit of producing the pencil by extrusion, **[1 max]**.*
no finishing required;
volume production;
one stage process including incorporation of lead;
cost-effective method of production; ***[1 max]***

(ii) *Award **[1]** for each distinct point in a brief description, **[2 max]**.*
linear molecule with individual atoms bonded by covalent bonding;
weak secondary bonding between the chains; ***[2 max]***

(iii) *Award **[1]** per distinct point in a description of the reversible effect of temperature on a thermoplastic, **[2 max]**.*
increase in temperature causes plastic deformation so thermoplastics can be shaped easily;
when cooled, the thermoplastic retains its shape but if reheated can be reshaped, *i.e.* a physical change takes place, not a chemical change;
the weak secondary bonding between the molecules allows the chains to slide over each other when heated; ***[2 max]***

(c) (i) *Award **[1]** for a reason why the plastic pencil can be regarded as an example of radical design and **[1]** for a brief explanation, **[2 max]**.*
radical in concept;
method for recycling vending cups;
radical in relation to the manufacturing process;
pencils traditionally manufactured from wood; ***[2 max]***

(ii) *Award **[1]** for identifying three distinct ways in which the plastic pencil meets the criteria for clean technology and **[1]** for each distinct point in an explanation, **[3 max]** for each distinct way, **[9 max total]**.*
conserves natural resources;
making the pencils from recycled materials reduces the need to utilize virgin raw materials;
virgin raw materials can be used for other purposes; ***[3 max]***

generate less waste;
provides a method for recycling the vending cups;
minimizes the negative impacts of the disposable vending cups; ***[3 max]***

Extrusion is a cleaner manufacturing technique;
minimal waste;
energy efficient process; ***[3 max]***

[9 max total]

9. (a) (i) *Award **[1]** for*
sintering; ***[1 max]***

(ii) *Award **[1]** for each distinct point in a brief description, **[2 max]**.*
pairs of electrons are weakly bonded together;
the electrons move freely at low temperatures; ***[2 max]***

(iii) *Award **[1]** for a way in which using superconductors for the train helps conserve resources and **[1]** for a brief explanation, **[2 max]**.*
because superconductors are sintered they require no extra processes for treatment or finish;
which conserves energy and materials;
superconductors are ceramic alloys which are very long-lasting;
hence do not easily become obsolete;
the use of superconductors means that trains require less energy to operate;
hence saving resources;
the cables can be smaller than conventional metal ones;
hence saving material resources; ***[2 max]***

(b) (i) *Award **[1]** for each of two appropriate responses from the list below, **[2 max]**.*
extreme weather conditions, *e.g.* high winds;
location of passenger terminals;
issues in relation to passengers boarding and disembarking;
passengers stranded above ground in the event of an emergency; ***[2 max]***

(ii) *Award **[1]** for identifying a way in which the levitating train is similar to an automated guided vehicle and **[1]** for a brief explanation.*
the train's route is marked out by the track;
the route of an AGV is marked out by a white line, IR rays or cables laid beneath the surface;
the train is driverless;
AGVs are similarly driverless; ***[2 max]***

(c) (i) *Award **[1]** for a reason why the levitating train can be regarded as an example of incremental design and **[1]** for a brief explanation, **[2 max]**.*
many parts of the train, *e.g.* the seats and other internal items, will not be changed from the designs in other trains;
although the levitating train is radical in relation to its mode of propulsion it is not radical in other aspects; ***[2 max]***

(ii) *Award **[1]** for identifying three distinct ways in which the levitating train can contribute to a sustainable energy policy and **[1]** for each distinct point in an explanation, **[3 max]** for each distinct way, **[9 max total]**.*
the trains are slightly more energy-efficient than conventional trains (due to no wheel on rail friction);
energy efficiency reduces consumption of natural resources;
energy efficiency reduces pollution; ***[3 max]***

levitating trains use electrical energy;
electrical energy can be produced from renewable resources, *e.g.* hydroelectric power;
this reduces consumption of fossil fuels to produce energy; ***[3 max]***

raised track makes more efficient use of land resources;
land use is an important consideration in a sustainable development policy;
land under the track can be used for other purposes, *e.g.* growing crops; ***[3 max]***

[9 max total]