



# **MARKSCHEME**

**November 2013**

**DESIGN TECHNOLOGY**

**Higher Level**

**Paper 2**

*This markscheme is **confidential** and for the exclusive use of examiners in this examination session.*

*It is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of the IB Assessment Centre.*

## 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 **WTTE** (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 for including an observatory (The View) in the design of the building [1 max].*  
visitor attraction;  
create income by charging visitors to use the observatory;  
make use of the height of the building; *[1 max]*
- (ii) *Award [1] for stating one reason for including a spire at the top of the building [1 max].*  
to give the building status;  
so the building stands out more in the landscape;  
increase the height; *[1 max]*
- (iii) *Award [1] for one reason for assembling the spire off-site before re-assembling it at the top of the building and [1] for a brief explanation [2 max].*  
to ensure it fits together;  
so assembly on site is straight forward;  
  
difficult to resolve any design problem at the top of The Shard;  
troubleshoot problems in safe/accessible environment; *[2 max]*
- (b) (i) *Award [1] for one reason why the restaurant area is larger than the observatory area even though the observatory covers more floors and [1] for a brief explanation [2 max].*  
prism/pyramid shape of the building;  
so higher floors have less floor area than lower floors; *[2]*
- (ii) *Award [1] for one reason why the restaurant area covers three floors and [1] for a brief explanation [2 max].*  
the restaurants will cater for different needs/offer a variety of food;  
for example, office workers will mainly want to use it for lunch but hotel guests will use it for breakfast;  
  
flexibility of use;  
different types of cuisines can be offered on different floors/floors may be shut off at quiet times; *[2 max]*

- (c) (i) *Award [1] for stating the number of floors not used regularly by people.* [1]  
19;
- (ii) *Award [1] for each correct distinct point for some floors remaining mainly unoccupied [3 max].*  
the building is very tall and is multi-purpose;  
at different levels there will be the need for specific services/storage areas etc;  
so some floors are left for use for noisy/smelly plant services/machinery;
- as it is a new building;  
to may take some time to attract business;  
to rent/occupy spare floors; [3 max]
- (d) (i) *Award [1] for stating one reason why solar heat gain will be less at the bottom of the building than at the top.* [1]  
shading from trees/other buildings;
- (ii) *Award [1] for each correct distinct point explaining why the blind systems may not help to reduce the energy needs of the building [3 max].*  
the blinds will block out daylighting on sunny days;  
this means that artificial light will need to be used more;  
which will increase the energy consumption of the building; [3]
- (e) (i) *Award [1] for one limitation of the blind system in relation to maintenance and [1] for a brief explanation.*  
the system will need to be regularly maintained;  
and any repairs will be very costly as each glass panel is a sealed unit; [2]
- (ii) *Award [1] for one limitation of the blind system for occupants of the building and [1] for a brief explanation.*  
reliability;  
if the system breaks down it will affect the working conditions in the building dramatically;
- Occupants of the building will not be able to operate the blinds individually;  
In order to regulate the amount of heat/light for their working position;
- Lack of views;  
The blinds could make the office seem claustrophobic/closed off; [2 max]

2. (a) *Award [1] for stating the percentile range used for adult shoe sizes in volume production.*

5<sup>th</sup> – 95<sup>th</sup> (male or female);

**[1]**

- (b) *Award [1] for each correct distinct point for a comparison of the use of qualitative and quantitative data when considering the ergonomic aspects of a design [3 max].*

quantitative data is data which can be measured in some way, for example, body dimensions or a temperature range *etc*;

qualitative data is based on individual perception, for example, one person will find a particular temperature comfortable while another will find it uncomfortable;

quantitative data is easier to use for designers as it is fairly constant/qualitative data is very varied;

the balance required between the use of quantitative and qualitative data depends on the context of the design;

**[3]**

3. (a) *Award [1] for one reason why toughness is important in the use of timber for roof beams in domestic buildings and [1] for a brief explanation.*  
so cracks will not propagate easily;  
roof beams need to last a long time/be very durable;
- cracks will not spread throughout the material;  
When joint are cut/holes drilled/fasteners used; **[2 max]**
- (b) *Award [1] for identifying how the structure of natural timber affects how a beam is cut to maximize its tensile strength and [1] for a brief description [2 max].*  
beams are constructed so the grain runs along the length of the beam;  
the beam will be weak if the grain runs across the beam; **[2]**
4. (a) *Award [1] for stating one reason why the concept of clean technology was **not** an issue for most governments during the industrial revolution [1 max].*  
governments were mainly interested in improving the economy;  
little quantitative data was available about the effects of industrial expansion on the environment;  
little public concern was raised about environmental issues; **[1 max]**
- (b) *Award [1] for each correct distinct point for an explanation of one reason why many approaches to clean manufacturing tend to be incremental [3 max].*  
cost;  
a radical rethink of the whole manufacturing process will be costly;  
and many companies cannot afford such an approach;
- values;  
those who run companies may not be very pro-active in relation to environmental concerns;  
and so do only see the need to make minor changes to the process;
- legislation;  
legislation may not be in place which forces companies to make radical changes;  
so those in charge do only what they have to do;
- priorities;  
a large company may have many different conflicting priorities for spending time and money;  
clean manufacturing may not be a top priority for them;
- R&D;  
The nature of the required technological development for effective clean manufacturing;  
May be done gradually over a period of time;
- risk;  
Less risky than a radical approach as the whole system is not altered at once;  
and effects can be monitored gradually; **[3 max]**

5. (a) *Award [1] for describing how the structure of LVL differs from the structure of plywood and [1] for a brief description [2 max].*  
plywood is created from thin layers of timber (veneers/plys) glued together with the grain of each layer at right angles to each other;  
while LVL is created from layers with the grain running in the same direction; **[2]**
- (b) *Award [1] for outlining one limitation of the composition of particle board (chipboard) for use as a structural material and [1] for a brief explanation [2 max].*  
suitable for internal use only;  
as the composition makes it very absorbent (unless specially treated);  
  
poor tensile strength;  
in comparison to most other manufactured boards/natural timber; **[2 max]**
6. (a) *Award [1] for stating one limitation of installing a hydroelectric system [1 max].*  
high capital/maintenance costs;  
needs to be located near a large, constant water supply; **[1 max]**
- (b) *Award [1] for each correct distinct point in comparing the overall efficiency conversion levels of using conventional coal and gas fossil fuels to create electricity [3 max].*  
coal is less efficient than gas;  
but both are very inefficient;  
as the conversion rate for coal is approx 30 % compared to that of gas of 40 %; **[3]**



**SECTION B**

7. (a) (i) *Award [1] for an outline of one possible reason why Porsche decided to produce bicycles as part of their corporate strategy and [1] for a brief explanation [2 max].*  
image;  
improves the “green” credentials of the company;  
  
market pull;  
the bicycle market has widened to include expensive products; **[2 max]**
- (ii) *Award [1] for describing the specific type of corporate strategy employed by Porsche in deciding to produce bicycles and [1] for a brief explanation [2 max].*  
diversification;  
the company decided to produce a very different type of product to cars; **[2]**
- (b) (i) *Award [1] for an outline of one advantage of manufacturing the pedals of the bicycle by high pressure die casting and [1] for a brief explanation [2 max].*  
good accuracy;  
important for such an intricate design;  
  
good surface finish;  
important for a quality/expensive product; **[2 max]**
- (ii) *Award [1] for each correct distinct point in explaining how work done by the cyclist is converted into mechanical motion when riding the bicycle [3 max].*  
human energy is converted to pedal rotations;  
rotary motion of the pedals is converted by the gear mechanism to rotary motion of the drive wheel;  
rotary motion of the drive wheel is converted to linear motion of the bicycle moving forward (forward velocity); **[3]**

- (c) (i) *Award [1] for an outline of one reason why the pedals are designed so the cyclist has to wear specialist shoes and [1] for a brief explanation [2 max].*  
it reinforces the specialist/high end market;  
and the status of the product;

performance;

the bike is high performance, therefore the pedalling efficiency is maximized by the use of specialist cycling shoes;

market development;

forces customers to purchase additional Porsche products;

**[2 max]**

- (ii) *Award [1] for each correct distinct point for an explanation of each of three reasons why many governments promote the use of bicycles as a form of transport [3 max] per reason.*

health;

cycling is a good form of exercise;

governments have a responsibility to increase health awareness issues/  
promote healthy lifestyles;

sustainable development;

cycling does not cause pollution/depletion of energy resources;

using bicycles instead of cars decreases environmental damage;

social reasons;

cycling can be done by most ages;

so whole families can enjoy riding together which promotes social bonding;

economics;

cycling is a cheap form of transport;

so available to all/cuts down fuel bills so releasing money to be spent on consumer goods;

congestion;

in many cities there is a problem with congestion on the roads caused by too many cars;

bicycles take up much less space than cars;

**[9 max]**

8. (a) (i) *Award [1] for outlining one reason why Honda decided to produce a hybrid version of the NSX car rather than an all electric version and [1] for a brief explanation [2 max].*  
with current technology electric vehicles are limited in the amount of miles/kilometres they can travel before requiring a recharge;  
hybrid vehicles provide some benefit of reduced environmental impact/pollution but still allow the car to be driven for the same distance as a comparable petrol/gas version;  
  
if the user does not have the opportunity to recharge the car;  
the car will still be able to be used;  
  
cost;  
hybrid vehicles are usually lower in cost than equivalent all electric vehicles which widens the market for the car; [2 max]
- (ii) *Award [1] for identifying how the introduction of electricity impacted on the market for mass produced motor cars and [1] for a brief description [2 max].*  
electricity made the assembly-line process quicker;  
cars could be produced more cheaply which made them affordable to more people; [2]
- (b) (i) *Award [1] for the life cycle stage of a life cycle analysis (LCA) in which a car has most impact on the environment and [1] for a brief explanation [2 max].*  
use;  
due to the amount of energy consumed/pollution created; [2]
- (ii) *Award [1] for each correct distinct point for an explanation of why a car company may decide to produce a concept car for auto shows even though they have no intention of turning it into a full production model [3 max].*  
image;  
shows they are innovative/pioneering company;  
constantly trying out new ideas/forward thinking;  
  
research and development;  
the company may include new features in a concept car;  
which may then be included in future production models if feedback is positive;  
  
consumer interest/loyalty;  
by showing innovative designs the company may develop an interest in their production models which could turn into sales;  
existing customers may be persuaded to change their car for a new model;  
  
test the market;  
a concept car may include radical new features/design;  
the company may want to test the reaction of retailers/consumers before deciding whether to include all/some features in future production models; [3 max]

- (c) (i) *Award [1] for one advantage to the consumer of cars produced by just-in-time (JIT) and [1] for a brief explanation [2 max].*  
efficiency;  
the consumer will know when they will receive the car after ordering/paying for it; [2]
  
- (ii) *Award [1] for each correct distinct point for each aspect in a discussion of the value of the use of the evaluation strategies user trial, user research and expert appraisal to a car company when putting a concept car in an auto show [3 max] for each reason.*  
user trial:  
cannot drive the car/no test drive;  
but can get feedback on aspects such as comfort, aesthetics etc;  
users will be car enthusiasts/may not be representative of the target market;  
  
user research:  
potential users may not visit a motor show;  
but read the publicity/be aware of the concept car;  
and are able to participate in online feedback;  
  
expert appraisal:  
motoring experts attend motor shows;  
and provide feedback based on their expertise/experience;  
which may affect further development of the concept car/influence the decision whether to go into production; [9]
  
- 9. (a) (i) *Award [1] for identifying the scale of production for the Geo Shelving unit and [1] for a brief explanation [2 max].*  
batch;  
the market for such an object will be limited to people who are attracted to the aesthetics; [2]
  
- (ii) *Award [1] for one use of mechanisation in the production of the Geo Shelving unit and [1] for a brief explanation [2 max].*  
electric (power) tools will be used for parts of the manufacturing process, for example, drills/sanders;  
these tools will be controlled by the skilled craftsmen; [2]
  
- (b) (i) *Award [1] for outlining one reason why the circle shapes have not been produced from hardwood and [1] for a brief explanation [2 max].*  
difficult to produce from hardwood;  
due to grain structure of wood/weak in places of diagonal grain; [2]
  
- (ii) *Award [1] for each correct distinct point for an explanation of how permanent joining techniques lead to planned obsolescence and associated environmental issues [3 max].*  
disassembly not possible;  
so parts cannot be easily replaced/reused;  
the glue used for joining makes recycling problematic; [3]

- (c) (i) *Award [1] for outlining one reason why distribution costs will be high for the Geo Shelving unit and [1] for a brief explanation [2 max].*

the unit cannot be flat-packed;

which means that much space will need to be used to transport it from the factory to the customer causing high transport costs;

increased/more expensive packaging;

due to the shape of the unit/to protect vulnerable parts;

*[2 max]*

- (ii) *Award [1] for each for suggesting three considerations in the design of the Geo shelving unit relating to the effect of external loads on the unit during use [3 max] per consideration.*

external loads refers to objects placed on the unit;

the unit is designed with smallest shapes at the top and largest at the bottom;  
so bigger items are stored on the lower shelves to ensure stability;

external loads give rise to internal forces;

tensile forces are caused by the external loading;

and are balanced by compressive forces within the structure;

to ensure equilibrium;

the designer will have created a factor of safety;

to ensure the structure can withstand higher loads than anticipated;

as the designer will not know the exact type of external loading;

the unit incorporates many glued surfaces;

glue helps the internal forces to move smoothly through the structure;

increasing stability;

length of shelves;

must not be too long;

to prevent deflection/sagging;

*[9 max]*

---