N11/4/DESTE/HP2/ENG/TZ0/XX/M

International Baccalaureate®
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MARKSCHEME

November 2011

DESIGN TECHNOLOGY

Higher Level

Paper 2

15 pages

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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 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.

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SECTION A

1. (a) (i) *Award **[1]** for stating the type of fixed cost represented by the $600 million investment.*
research and development (R&D); ***[1]***

(ii) *Award **[1]** for stating one reason why the running costs may vary.*
$3/100 miles may vary as it depends on how/where the car is driven (urban/rural) / price of electricity may increase/decrease; ***[1]***

(iii) *Award **[1]** per distinct point in an outline of one reason why the servicing costs of the Leaf car should be lower than those for a petrol (gas) car.*
for a petrol driven car most of the servicing costs relate to maintenance of the engine;
the engine for the electric car is much simpler to maintain; ***[2]***

(b) (i) *Award **[1]** per distinct point in an outline of one reason for naming the Nissan car "Leaf".*
a leaf is associated with the colour green;
green design is associated with impact on the environment/sustainability;

leaf relates to the environment;
the name promotes the car as environmentally friendly/green; ***[2 max]***

(ii) *Award **[1]** per distinct point in an outline of why an electric car may not be considered a green design.*
much electricity is derived from burning fossil fuels/coal;
which causes environmental damage/pollution; ***[2]***

(c) (i) *Award **[1]** for stating one benefit of the incremental design of the Leaf car in relation to its shape and form.*
cost-effective;
standard parts;
increased consumer confidence;
looks like a normal car;
does not stand out as different; ***[1 max]***

(ii) *Award **[1]** per distinct point in an explanation of one limitation of the Leaf car for people living in apartments.*
apartment dwellers may not have the use of a garage/the parking space is away from the building;
the car needs to be close enough to a charging outlet/electricity point;
so it can be linked up to be charged;

the charging point would need to be specific to an apartment;
otherwise occupiers of other apartments would be charged for the electricity;
if the charging point is for communal use; ***[3 max]***

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(d) (i) *Award **[1]** for stating why the design of the Leaf car is not based on the typical daily journey data.*
a factor of safety in case of unexpected diversions;
road closures which add to the journey;
the car needs to appeal to a wide range of users, some of whom may not be typical;
convenience for car users *i.e.* you don't need to charge it every day; ***[1]***

(ii) *Award **[1]** per distinct point in a discussion of why investment in the network of charging points is supported by the government.*
targets;
governments need to reduce pollution to meet environmental targets;
governments will financially support projects such as a network of charging points;

risk;
governments can take on more risky investments than most private companies;
as they are not directly responsible to stakeholders;

sustainability;
governments need to satisfy internationally agreed targets for reducing CO_2 emissions;
electric cars will help meet the targets;

impetus;
once a new scheme is established with appropriate funding;
other investors are more likely to invest in order to extend the scheme*;* ***[3 max]***

(e) (i) *Award **[1]** per distinct point in an outline of one reason why private companies may establish charging points for their employees.*
employees might live a long way away from work;
so need to charge their car after getting to work so it has enough charge to get home;

social responsibility/image;
companies may want to be seen to support environmentally sustainable measures;

perk for employees;
the company may want to show it looks after the needs of its workers;

companies may adopt electric cars as company cars;
providing charging points would be part of the corporate strategy/may be free for employees

convenience;
employees can charge the car at home or at work;

efficiency;
employees do not need to waste time looking for a charging point; ***[2 max]***

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(ii) *Award **[1]** per distinct point in an outline of one reason why the UK government decided to create a pilot network of charge points in three cities of one region rather than trial the scheme in just one city.*
many people travel between urban centres (cities) rather than just in one urban centre;
so to evaluate the trial a realistic model needs to be established;

for the scheme to succeed local authorities will need to take ownership of the scheme;
feedback from different authorities is important to expand it further;

car owners' attitude to the scheme may vary from one urban centre to another;
so a trial needs to be established to provide data from a wide range of uses;

the infrastructure (geography) of urban centres may be different;
so the scheme needs to be trialled to take this into account*;* ***[2 max]***

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2. (a) *Award **[1]** for stating the power source which was used before electricity in mass production systems.*
steam; ***[1]***

(b) *Award **[1]** per distinct point in an explanation of the contribution of electricity to the evolution of assembly-line production.*
assembly line production can be mechanised or automated;
electrically powered machines speeded up assembly line production;
resulting in higher productivity with a smaller labour force; ***[3]***

3. (a) *Award **[1]** per distinct point in a description of a bevel gear.*
bevel gears are used to turn mechanical motion through a right angle;
e.g. in a hand drill or manual whisk; ***[2]***
***[1 mark]** for a suitable example.*

(b) *Award **[1]** each for listing the two components of a worm gear.*
screw thread (worm);
worm wheel; ***[2]***

4. (a) *Award **[1]** for stating the manufacturing technique which uses a parison.*
blow moulding; ***[1]***

(b) *Award **[1]** per distinct point in an explanation of why compression moulding is an appropriate technique to manufacture plastic saucepan handles.*
saucepan handles need to resist high temperatures;
so the plastic needs to be a thermoset;
compression moulding is a suitable technique for use with thermosets; ***[3]***

5. (a) *Award **[1]** per distinct point in a description of filament winding.*
filaments (fibres) are passed through a resin bath;
then wound onto a mandrel in a variety of orientations; ***[2]***

(b) *Award **[1]** for each of two reasons of why filament winding is suitable for manufacturing fishing rods.*
suitable for hollow shapes;
produces a very strong/tough product;
good strength to weight ratio;
flexibility;
low density; ***[2 max]***

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6. (a) *Award **[1]** for stating the equation used to calculate heat gain or loss through a wall in a building.*
heat flow = wall area x temperature difference x U value; ***[1]***

(b) *Award **[1]** per distinct point in an explanation of how the U-value of a material affects the heat gain or loss for the walls of a building.*
U value is a measure of the thermal conductivity of a material;
the higher the U value the greater the conductivity;
different materials have different U values so selecting a material with a high U value will mean more heat loss than selecting a material with a low U value; ***[3]***

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SECTION B

7. (a) (i) *Award **[1]** per distinct point in an outline of one reason why the bag may appeal to some consumers in relation to their set of values.*
consumers who appreciate "green" products;
due to their eco values;

consumers who are philanthropic/like donating to charity;
due to their charitable values; ***[2 max]***

(ii) *Award **[1]** per distinct point in an outline of one reason why the company is able to make a profit from the sale of the bags despite donating half the profits to charity.*
most of the materials are free;
material cost is a significant cost of a final product;

price;
the bags are likely to be priced high enough to cover the various costs, the charity donation and leave a good profit margin;

volume;
if a large number of bags are sold the costs will easily be covered allowing for a substantial profit margin on the sales; ***[2 max]***

(b) (i) *Award **[1]** per distinct point in an outline of one physical property which is important for the design of the bag.*
density;
the bags will be carried around by users so should not be too heavy; ***[2]***

(ii) *Award **[1]** per distinct point in an explanation of why the type of bonding structure of the plastic material aids recycling of the bag at the end of its life.*
the material is made up of linear chains of molecules;
there are weak forces of attraction/secondary bonds between the chains of molecules;
the thermoplastic material can be easily broken down using heat; ***[3]***

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(c) (i) *Award **[1]** per distinct point in an outline of one advantage of the use of rivets to attach the straps to the bag.*
strong connection/joining technique;
suitable for tough materials;

cost-effective;
suitable for different scales of production; ***[2 max]***

(ii) *Award **[1]** per distinct point **[3 max]** for each of the three aspects of how the company promotes three different aspects of triple bottom-line-sustainability **[9 max]**.*
social;
money is donated to charity;
which helps fire fighters to provide a valuable social service;

environmental;
recycling of fire hoses;
helps conserve resources and energy/reduces pollution/reduces waste;

economic;
sale of products made from the hoses contributes to economic growth;
for the company/the wider economy; ***[9 max]***

8. (a) (i) *Award **[1]** per distinct point in an outline of why hardwood is an appropriate material to make the rockers of the chair.*
hardwood has a close/dense grain;
which limits cracks forming in the timber;

aesthetics;
hardwood has an attractive grain pattern/colour;

mechanical property/fittings;
the hardwood is good for attaching fasteners; ***[2 max]***

(ii) *Award **[1]** per distinct point in an outline of one advantage of making the rockers of the chair from laminated timber instead of from a hardwood.*
cheaper material;
laminated timber is constructed from off-cuts of timber/layers of different timbers;

structural stability;
it is not susceptible to warping/bending;

appropriate manufacturing technique;
laminated timber can be formed in a mould;

strength;
the glue between the layers increases the strength to weight ratio; ***[2 max]***

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(b) (i) *Award **[1]** per distinct point in an outline of one benefit of using plastic to make the seat of the chair.*
cheap material;
cost-effective to produce;

seat is a complex shape;
plastic is easy to mould into complex shapes;

easy to produce in a range of colours;
increases aesthetic appeal/consumer choice;

plastic is a tough material;
the seat will not crack easily;

recyclability;
thermoplastic is a readily recyclable material; ***[2 max]***

(ii) *Award **[1]** per distinct point in an explanation of the most likely technique for joining the metal frame to the wooden rockers.*
fasteners/screws/bolts;
which are suitable for joining metal to wood;
because of the different properties/characteristics of the two materials; ***[3]***

(c) (i) *Award **[1]** per distinct point in an outline of the relationship of body load to the chair.*
body load is a load without physical contact with the chair/structure;
it is the chair's own weight/mass; ***[2]***

(ii) *Award **[1]** per distinct point **[3 max]** in an explanation relating to the relationship between external loads and internal forces, equilibrium and the structure of the chair.*
external loads are caused by someone sitting on the chair;
the external load gives rise to internal forces;
the forces will be tensile and compressive;

each of the metal structural members are very thin;
the structural members must be stiff enough to resist deflection;
resulting in the need for bracing members;

tensile forces tend to stretch or extend a structural member;
compressive forces tend to compress or shorten a structural member;
the tensile and compressive forces need to be balanced in order for the chair to be in equilibrium;

the design of the curve of the rockers and position of the seat would need to be carefully considered;
in terms of the centre of gravity;
so that external and internal forces would be balanced/equilibrium achieved; ***[9 max]***

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9. (a) (i) *Award **[1]** per distinct point in an outline of the importance of density to the choice of material for the Human dynamo.*
the device needs to be lightweight/low density;
so it is easily carried around when attached to the body; ***[2]***

(ii) *Award **[1]** per distinct point in an outline of the materials group to which piezoelectric materials belong.*
composites;
the material is made up of two or more materials that are bonded together;

smart material;
one or more property can be altered significantly influencing its application; ***[2max]***

(b) (i) *Award **[1]** per distinct point in a description of the type of energy produced to create the electric current.*
kinetic;
created by movement of the human body/the athlete; ***[2]***

(ii) *Award **[1]** for each distinct point in an explanation of why the material for the casing of the Human Dynamo needs to be bio-compatible with the human body.*
some materials are rejected by the human body;
because they are not bio-compatible;
bio-compatible materials will not cause any health or comfort issues; ***[3]***

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(c) (i) *Award **[1]** per distinct point in an outline of one physiological ergonomic factor important to the design of the Human Dynamo.*
comfort;
the device must not cause any discomfort to the user when moving around; ***[2]***

(ii) *Award **[1]** per distinct point **[3 max]** for each issue discussed in relation to the invention of the Human Dynamo becoming an innovation.*
cost;
the device must be affordable;
and value-for-money to the target market/audience;

reliability;
the device must work reliably;
over a long period of time;

testing;
prototypes must succeed in various types of tests;
in order to ensure that it is ready for the marketplace/safe;

suitable investment;
in the technology;
in order to develop it further and widen the market;

risk;
potential investors may consider the technology/product too risky;
for it to succeed in the marketplace;

suitable marketing/advertising;
people in the target market need to be made aware of the product;
and where they can purchase it;

cost-effectiveness;
the final design needs to be cost-effective to manufacture;
in order for a profit to be made;

standards/legislation;
may vary across different market sectors/regions;
making the product more expensive to produce; ***[9 max]***

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