N12/4/DESTE/HP2/ENG/TZ0/XX/M

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MARKSCHEME

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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 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. 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 stating the type of load exerted by the wind on the roof of the airport building.*
external; ***[1]***

(ii) *Award **[1]** for stating the drawing technique used to create the sketch design.*
perspective;
freehand drawing/perspective; ***[1 max]***

(iii) *Award **[1]** for each point in an outline of the idea generating technique most likely used by the designer for the shape of the airport **[2 max]**.*
analogy;
idea taken from the shape of a bird/aircraft (two wings and a tail); ***[2]***

(b) (i) *Award **[1]** for calculating the floor area of the total airport site area and **[1]** for calculating the percentage of the floor area in relation to the site area.*
floor area: 570 000 + 140 000 = 710 000 m^2;
site area: 1255 hectares = 12 550 000m^2 = 5.7 %; (*allow 5.6 %*) ***[2]***

(ii) *Award **[1]** for stating a reason why there are more seats per unit floor area in Terminal 1 than in Terminal 2 and **[1]** for a brief explanation **[2 max]**.*
passengers will move through to Terminal 1 after check-in to await their flight;
therefore fewer seats are needed;

Terminal 2 is only used when Terminal 1 exceeds capacity;
so, at many times of the year Terminal 2 will not be used/there are no departure gates in Terminal 2; ***[2 max]***

(c) (i) *Award **[1]** for stating how the two pieces of data for the passenger check-in counters at Terminal 2 are related.*
each counter can be operated as a single or double check-in; ***[1]***

(ii) *Award **[1]** for each point in an explanation of which terminal is likely to be the most crowded at capacity **[3 max]**.*
Terminal 2, as it has 25 % of the floor area compared to Terminal 1;
though if all check-ins are in use it has 39 % passenger check-in capacity of Terminal 1;
and only 8.5 % of the seating capacity of Terminal 1; ***[3]***

(d) (i) *Award **[1]** for stating the year with the least amount of energy consumed per passenger.*
2007–2008; ***[1]***

(ii) *Award **[1]** for each discrete point in a discussion of the pattern of energy consumption per passenger between the years 2004 and 2009 **[3 max]**.*
2004–2005 most energy consumption but in subsequent years the trend is a reduction of consumption;
though in 2008–2009 there is the same amount of passengers as in 2007–2008;
but more energy is consumed per passenger which bucks the trend; ***[3]***

(e) (i) *Award **[1]** for calculating the number of tonnes of timber based materials recycled in the year 2009–10 and **[1]** for calculating the percentage.*
$535.6 + 456.4 = 992.00$ tonnes;
$= 86$ %; ***[2]***

(ii) *Award **[1]** for identifying the material group that is likely to be most difficult to recycle and **[1]** for a brief explanation **[2 max]**.*
plastics;
because they will be composed of thermoplastics and thermosetting plastics which will need sorting in order to be recycled separately/thermosets are difficult to recycle ***[2]***

2. (a) *Award **[1]** for stating the type of deformation a material undergoes beyond its yield point.*
plastic; ***[1]***

(b) *Award **[1]** for each discrete point in an explanation of the relationship between deflection and stiffness in structures **[3 max]**.*
if an external load is applied to some part of a structure, that part will be deflected;
the amount of deflection depends on the size of the load;
and the stiffness of the structure; ***[3]***

3. (a) *Award **[1]** for each point in a description of biofuel **[2 max]**.*
fuel which is derived from natural materials;
e.g. waste cooking oil (vegetable/sunflower); ***[2]***

(b) *Award **[1]** for each point in a description of the function of clean coal technology **[2 max]**.*
reduction of environmental impact of coal energy generation;
by eliminating/reducing carbon dioxide emissions; ***[2]***

4. (a) *Award **[1]** for stating the type of gear system used in a metal lathe mechanism.*
compound;
worm; ***[1 max]***

(b) *Award **[1]** for each distinct point in a discussion of belt and chain drive mechanical systems in relation to performance and cost **[3 max]**.*
if the distance between the shafts is large in a belt drive system it will tend to slip and so be less efficient than a chain drive system which does not slip;
but a chain drive system is more expensive both in capital cost/maintenance cost;
and a belt drive can be used with variable speed cones; ***[3]***

5. (a) *Award **[1]** for each of two functions of the resin in the process of hand lay-up moulding **[2 max]**.*
fills any gaps in the fibreglass;
provides a smooth finish;
colour;
hard surface/durability;
binds the fibreglass together; ***[2 max]***

(b) *Award **[1]** for each point in an outline of one benefit of using the technique of vacuum bagging in a composite lay-up process **[2 max]**.*
large products are possible;
because the air pressure is evenly distributed across the mould;

good quality products can be made;
through the use of pre-pregs;

clean production method;
with little waste;

low moulding costs;
because the process requires little maintenance/is cheap to install;

cost effective;
when used for complex shapes; ***[2 max]***

6. (a) *Award **[1]** for stating the definition of the term building envelope.*
the exterior surface of a building's construction (walls, windows, floor, roof)/ building shell; ***[1]***

(b) *Award **[1]** for each distinct point in an explanation of how the selection of different construction materials can contribute to the heat loss or gain from a building **[3 max]**.*
different materials have different U-values/properties;
the U-value is a measure of the thermal conductance of a material;
the higher the U-value, the greater the conduction;
components of the envelope can create paths for the transfer of thermal energy; ***[3 max]***

SECTION B

7. (a) (i) *Award **[1]** for each point in a description of the structure of plywood **[2 max]**.*
thin layers (veneers) of timber glued together;
with the grain of each layer at right angles to each other; ***[2]***

(ii) *Award **[1]** for each point in an outline of one physical property required for the surface finish of the Embrace coffee table **[2 max]**.*
hard;
resistance to scratching; ***[2]***

(b) (i) *Award **[1]** for each point in an outline of one reason for designing the coffee tables with a choice of surface finishes **[2 max]**.*
widens the market/different tastes;
consumers can match colour/grain pattern with other furniture/surroundings; ***[2]***

(ii) *Award **[1]** for each point in a discussion of one ergonomic consideration for the design of the handholds in the smaller version of the tables in Figure 6 **[3 max]**.*
size of the hole;
to accommodate size of hands of most users;
to allow for good grip;

smooth edges;
so no health and safety risk/no discomfort to the user;
prohibiting ease-of-use; ***[3 max]***

(c) (i) *Award **[1]** for each point of an outline of the scale of production for the Embrace coffee tables **[2 max]**.*
batch;
not a mass market product/available in different surface veneers; ***[2]***

(ii) *Award **[1]** for each distinct point in an explanation of three advantages of manufacturing the coffee tables with the technique of lamination **[3 max]** per advantage.*
lamination does not require a solid piece of flawless timber;
it is constructed of thin strips of timber;
which can come from different trees;

laminated timber is strong;
due to the use of adhesives;
between each layer;

lamination is cost-effective;
for various scales of production;
reduced waste/same mould can be used both parts of the table;

customisation;
lamination allows just the surface laminate/veneer;
to be changed according to order;

laminating is suitable for curved shapes;
the strength of the glue helps to keep the shape;
by preventing spring back;

laminated timber has good strength to weight ratio;
which means it can be used for slender structures;
and so increase aesthetic appeal; ***[9 max]***

8. (a) (i) *Award **[1]** for each point in an outline of why the Dyson fan has been designed to oscillate 90° **[2 max]**.*
in order to spread the effect of the cool air;
across a wide area in front of the fan/from a corner position; ***[2]***

(ii) *Award **[1]** for each point in an outline of why the Dyson fan has been designed with a tilting mechanism **[2 max]**.*
so that airflow can be directed at different angles;
in order to accommodate users in different positions/increase comfort; ***[2]***

(b) (i) *Award **[1]** for each point in an outline of one advantage of the Dyson fan operating with a smooth airflow **[2 max]**.*
eliminates the buffeting of air which is usually produced by fans with blades;
so loose paper on a desk will not be disturbed/blown away/increased comfort for the user; ***[2]***

(ii) *Award **[1]** for each point in an explanation of the need for a large design team to develop the Dyson fan **[3 max]**.*
the fan required a complex research and development phase;
with involvement from a range of specialists/different expertise for different aspects of the product;
difficult/impossible for one person to have all the skills/knowledge required / new/radical technology; ***[3 max]***

(c) (i) *Award **[1]** for each point in an outline of one way in which the Dyson fan has been designed to accommodate a wide percentile range **[2 max]**.*
adjustable;
so it can be used by people of different heights to increase comfort; ***[2]***

(ii) *Award **[3]** for each advantage of the Dyson fan in Figure 7 compared to the conventional fan in Figure 8 in relation to ease of maintenance, safety and aesthetics **[3 max]** per aspect.*
ease-of-maintenance:
no blades/grill;
so easier to keep clean;
no dust/dirt traps;

safety:
no blades so safer;
less chance of someone cutting themselves;
especially young children;

more hygienic;
dust on blades/grill of a conventional fan;
get blown back into the environment;

aesthetics:
sleek design;
controls are integrated into the product casing;
to achieve an uncluttered surface finish; ***[9 max]***

9. (a) (i) *Award **[1]** for each point in an outline of one reason why the toaster has a variable browning function **[2 max]**.*
consumer choice;
people have different preferences for how they like the toast; ***[2]***

(ii) *Award **[1]** for each point in an outline of one reason why the toaster has a mid-cycle cancellation button **[2 max]**.*
user might have set the wrong controls;
and want to stop the cycle to reset it;

user might need to stop the cycle to deal with something unexpected;
for example, doorbell rings;

different types of bread toast/brown at different rates;
user might not be familiar with a bread type and needs to stop the cycle once appropriate toasting/browning is achieved; ***[2 max]***

(b) (i) *Award **[1]** for each point in an outline of one disadvantage of the Radio-Toaster for the consumer **[2 max]**.*
if one function fails the consumer has to replace the whole product;
or buy a separate toaster or radio;

only suitable to be used in the kitchen;
may need to buy another radio for use in other rooms;

large product;
may take up too much space on the work surface;

lack of flexibility in use of the radio in the kitchen;
i.e. has to be placed near a power socket; ***[2 max]***

(ii) *Award **[1]** for each point in an explanation of one criteria consumers may use to evaluate the Radio-Toaster for value-for-money in relation to long-term use **[3 max]**.*
reliability;
both aspects need to work well;
even though one aspect may be used more frequently than the other;

ease of maintenance;
crumbs need to be cleared easily from the toaster part;
without damaging the sensitive radio parts by shaking the product upside down;

durability;
materials need to resist scratching;
colours not fade;

running costs;
the product should not use more energy than separate products;
and ideally would be cheaper to run; ***[3 max]***

(c) (i) *Award **[1]** for each point in an outline of one reason why the Radio-Toaster may satisfy a green design policy **[2 max]**.*
reduction in the use of resources/energy/materials compared to the production of two separate products;
so less impact on the environment; ***[2]***

(ii) *Award **[1]** for each point in a discussion of the Radio-Toaster in relation to invention, innovation and design **[3 max]** per aspect.*
Invention:
not an invention as such;
but a combination of two existing inventions;
no new technology involved;

Innovation:
innovative in relation to converging two products into one;
development of an existing market for the two types of products;
novelty value;

Design:
retro styling/fashionable;
rounded shape for aesthetics/safety;
ensuring both aspects work independently;
design challenge was to combine two products into one;
materials chosen to resist heat and aesthetics;
controls separated for the two functions; ***[9 max]***