M14/4/DESTE/HP2/ENG/TZ0/XX/M

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MARKSCHEME

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DESIGN TECHNOLOGY

Higher Level

Paper 2

13 pages

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 ***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.

SECTION A

1. (a) (i) *Award **[1]** for stating one reason for producing the case in bright colours **[1 max]**.*
easy to identify if dropped into the water when sailing *etc*;
fits in with the style of the product/product family;
increased consumer choice; ***[1 max]***

(ii) *Award **[1]** for stating one way that the corporate strategy of diversification has been used for the design of the case.*
designed to be available in four colours; ***[1]***

(iii) *Award **[1]** for each of two distinct correct points in a description of the case as part of a product family **[2 max]**.*
the company is using the design as the basis of waterproof cases for other products/the iPhone;
a product family would offer the company a cost-effective way of developing its product portfolio by reducing R&D costs/use common parts/materials/increase consumer base; ***[2]***

(b) (i) *Award **[1]** for a reason for why the case may not be waterproof if left in water at a greater depth than one metre and **[1]** for a brief explanation **[2 max]**.*
increasing the depth beyond one metre will create more forces/pressure on the case;
which may affect its waterproof qualities/make it less than 100 % waterproof; ***[2]***

(ii) *Award **[1]** for stating which fixed costs are likely to be highest for the case and **[1]** for a brief explanation **[2 max]**.*
research and development/R&D;
materials research would have been complex/expensive/time-consuming; ***[2]***

(c) (i) *Award **[1]** for stating the evaluation strategy for the shockproof test.*
performance test; ***[1]***

(ii) *Award **[1]** for each of three distinct correct points in an explanation of the limitations of the strategy of the shockproof test in terms of the product life cycle of the iPad **[3 max]**.*
the iPad is a very sensitive electronic device;
users may think the product is entirely shockproof;
however the internal components could easily become damaged/the case may be very durable but the iPad is not; ***[3]***

(d) (i) *Award **[1]** for stating the manufacturing technique that would be used to produce the case.*
injection moulding; ***[1]***

(ii) *Award **[1]** for each of three distinct correct points in an explanation of one disadvantage of the test to check the waterproof seal **[3 max]**.*
if the seal is not watertight;
the user will only know by the stream of bubbles to the surface;
but by then the water will have entered the case and could have damaged the iPad; ***[3]***

(e) (i) *Award **[1]** for a potential safety issue for the users when fitting the case and **[1]** for a brief explanation **[2 max]**.*
finger traps;
users may pinch the skin/bruise fingers by getting them trapped between the case and the iPad;

use of plastic strut as a lever could cause the strut to break;
damage the user/slip and damage the user's hand; ***[2 max]***

(ii) *Award **[1]** for a reason why some people might not be able to fit the case correctly even though they understand the instructions and **[1]** for a brief explanation **[2 max]**.*
people with limited finger movement may not have the dexterity/strength in their fingers;
to prise the edges of the case around the iPad; ***[2]***

2. (a) *Award **[1]** for stating the type of drawing shown in Figure 2.*
3D exploded drawing/exploded isometric/perspective; ***[1]***
Do not accept isometric

(b) *Award **[1]** for each of three distinct correct points in a discussion of one advantage of this type of drawing for the consumer **[3 max]**.*
components are labelled for ease of recognition;
shows how components fit together;
can lay out the components as they are shown in the drawing;

no text;
so no language issues for selling in different countries;
the company does not have to produce different versions / cost effective for the company; ***[3 max]***

3. (a) *Award **[1]** for each of two distinct correct points in a description of the type of polymer chain in the plastic used for the bottle **[2 max]**.*
linear;
with weak secondary bonds; ***[2]***

(b) *Award **[1]** for each of two distinct correct points in a description of the function of the mandrel in the blow moulding process **[2 max]**.*
the mandrel blows pressurised air into the parison;
to inflate the softened plastic to the shape of the mould;

the mandrel is also used to elongate the softened parison;
before it is inflated/pressurised air is blown to take the shape of the mould; ***[2]***

4. (a) *Award **[1]** for stating which product life cycle stage applies to the wind turbine in Figure 4.*
early; ***[1]***

(b) *Award **[1]** for each of three distinct correct points in an explanation of one limitation of the wind turbine for the local environment **[3 max]**.*

visual pollution;
many people may consider the turbine to create visual pollution;
as they may be considered ugly or not fit in with the local surroundings;

noise pollution;
wind turbines create noise as they turn;
this may create a disturbance to those living nearby;

fittings/components to secure the turbine to the roof;
may become loose with continued use/high winds;
the turbine falls from the roof causing a hazard;

birds may use the turbine for roosting when it is not turning;
when it starts turning, they are injured;
or may fly into the machine; ***[3 max]***

5. (a) *Award **[1]** for stating which material is the strongest and **[1]** for a brief explanation **[2 max]**.*
material D;
it has the highest (ultimate) tensile strength; ***[2]***

(b) *Award **[1]** for stating which material is the stiffest and **[1]** for a brief explanation **[2 max]**.*
material B;
the material with the smallest strain is the stiffest/it has the highest Young's modulus; ***[2]***

6. (a) *Award **[1]** for stating how "end-of-pipe" relates to clean manufacturing.*
it is the addition of clean-up technologies / removes pollutants at the end of a manufacturing process; ***[1]***

(b) *Award **[1]** for each of three distinct correct points in an explanation of one reason why manufacturers may take an incremental approach to the adoption of clean technology **[3 max]**.*
cost;
a radical approach would mean a major overhaul of the manufacturer's system which would be very expensive;
and might mean that the company would have to raise prices and be less competitive;

lack of legislation/incentive;
to force manufacturers to make radical changes;
so only minor/cosmetic changes are made in order to appear to be doing something;

lack of motivation;
manufacturers may argue that they have higher priorities;
especially in very competitive markets/difficult business conditions;

lack of suitable technology;
to make a major change to the manufacturing system;
which would bring about considerable environmental benefits; ***[3 max]***

SECTION B

7. (a) (i) *Award **[1]** for a reason for designing the ladder with rubber feet and **[1]** for a brief explanation **[2 max]**.*
rubber is non-slip;
so provides a safer/better grip to the ground/floor surface;

rubber is a softer material than metal;
so will not damage/scratch floor surfaces;

rubber feet protect the metal ladder ends;
from damaging surfaces when the ladder is being carried around/carried in the boot of a car; ***[2 max]***

(ii) *Award **[1]** for stating the importance of density in the selection of materials for the ladder and **[1]** for a brief explanation **[2 max]**.*
if the material is too dense;
the ladder will be too heavy for one person to carry; ***[2]***

(b) (i) *Award **[1]** for stating a reason for using the non-ferrous metal for the Versatile Ladder in relation to product cycle and **[1]** for a brief explanation **[2 max]**.*
the ladders will often be used in high moisture conditions;
non-ferrous metals do not oxidize/rust in these conditions which prolongs the life cycle of the ladders; ***[2]***

(ii) *Award **[1]** for each distinct correct point in an explanation of how the manufacturer of the Versatile Ladder has taken into account quality control and quality assurance measures **[3 max]**.*
the purchaser has quality assurance as the manufacturer provides a 10 year guarantee;
the manufacturer must have effective quality control measures in place for selection of good materials and production of the ladders;
in order to be confident of providing such a long guarantee; ***[3]***

(c) (i) *Award **[1]** for stating which component of the Versatile Ladder is most likely to reduce the life cycle of the product and **[1]** for a brief explanation **[2 max]**.*
hinges;
as they are moving parts which are likely to wear out first/due to wear and tear as the ladders are used in different configurations;

rubber feet;
likely to become worn via contact with rough/abrasive surfaces; ***[2 max]***

(ii) *Award **[1]** for each of three distinct correct points in an explanation of each of three ways in which the designer has considered external loads in the design of the Versatile Ladder **[3 max]** per category **[9 max]**.*
the ladders are designed to withstand a load of 136 kg;
so they are suitable for use by almost all adults;
only extremely heavy people would not be able to use the ladders safely;

the ladders may be used with the platform/as a form of scaffolding;
this may suggest that more than one person can use the structure at the same time;
but two adults may exceed the 136 kg limit;

the designer will have taken into account *factor of safety* when designing the ladders;
so although 136 kg is stated as the maximum load;
the ladders are likely to withstand a higher load without collapsing/breaking;

the designer has had to consider other external loads apart from the user;
such as equipment/materials carried onto the structure;
as well as gusts of wind;

the ladders are designed to be used in different configurations;
the relationship of external loads to internal forces will vary depending on the type of configuration;
the designer needs to ensure that each configuration is suitable to withstand the external loads; ***[9 max]***

8. (a) (i) *Award **[1]** for stating the technique used for joining the components of the steel frame and **[1]** for a brief explanation **[2 max]**.*
welding/brazing/fusing;
because a strong/permanent joint is required; ***[2]***

(ii) *Award **[1]** for stating the manufacturing technique used for creating the metal wires and **[1]** for a brief explanation **[2 max]**.*
extrusion/drawing;
metal rods are squeezed through a die which creates a wire of the correct diameter/surface finish; ***[2]***

(b) (i) *Award **[1]** for stating one maintenance issue for this type of furniture and **[1]** for a brief explanation **[2 max]**.*
cleaning of the wires;
will take a long time as dust will be trapped between the wires/spilt liquids will be difficult to remove;

the treatment may become damaged/worn;
and spoil the aesthetics/appearance;
repair of the treatment will be difficult/expensive; ***[2 max]***

(ii) *Award **[1]** for each of three distinct points in an explanation of how the strategy of product development could be used to create a design family of the stools **[3 max]**.*
the design idea can be modified to create a variety of products;
for example different sizes/shapes which form a design family;
to increase choice for consumers; ***[3]***

(c) (i) *Award **[1]** for stating one potential safety issue for the use of this type of furniture in a family home and **[1]** for a brief explanation **[2 max]**.*
young children playing with the furniture;
could get fingers trapped between the wires;

very young children/toddlers;
may cause the table/stool to topple over on them; ***[2 max]***

(ii) *Award **[1]** for each of three distinct correct points in an explanation of how the designer has taken into account the properties of tensile strength, stiffness and toughness in the design of this type of furniture **[3 max]** per property **[9 max]**.*
tensile strength:
the stool must be strong enough to withstand external loads;
and incorporate a factor of safety;
the (geometrical) arrangements of the wire structure provides good tensile strength;

stiffness:
the wire structure must have high stiffness;
in order not to deflect when external loads are applied;
the (geometrical) arrangement of the wire structure spreads the external loads evenly so stiffness is maintained throughout the structure;

toughness:
metal is a tough material;
cracks will not easily propagate through the metal wires;
even though such furniture is likely to endure considerable wear and tear; ***[9]***

9. (a) (i) *Award **[1]** for each of two specifications of the Natural House that conform to the criteria for appropriate technology **[2 max]**.*
uses local/natural materials;
uses local labour/traditional crafts; ***[2]***

(ii) *Award **[1]** for a way in which maximizing daylight contributes to the objectives of a low-carbon house and **[1]** for a brief explanation **[2 max]**.*
plenty of daylight minimizes the use of artificial light powered by electricity;
much electricity is produced by burning fossil fuel with high carbon emissions;

plenty of daylight could provide passive solar heating;
thus reducing dependence on heat produced from the burning of fossil fuels/electricity; ***[2 max]***

(b) (i) *Award **[1]** for a reason why clay is a suitable material for the roof tiles and **[1]** for a brief explanation **[2 max]**.*
moisture resistance;
clay tiles do not deteriorate much in high moisture conditions;

natural appearance/aesthetics;
clay tiles are available in various colours/textures so can be chosen to blend into the local environment;

construction;
clay tiles are easy to fit using traditional skills;

manufacture;
clay tiles are easy/cost-effective to produce in different volume scales;

availability;
clay is an abundant material/easily sourced; ***[2 max]***

(ii) *Award **[1]** for each of three distinct correct points in a suggestion of why the design of the clay blocks for the wall helps to reduce heat loss **[3 max]**.*
the honeycomb shape/structure traps air;
the air absorbs heat from the sun/heat from inside the building;
the air acts as a insulation layer; ***[3]***

(c) (i) *Award **[1]** for a reason why the use of sheep's wool is cost-effective as an insulation material for the floors and roof and **[1]** for a brief explanation **[2 max]**.*
the house utilizes natural, locally available materials so the wool must be easily/cheaply available from farms;
not be of a high quality for creating textiles/no associated manufacturing costs as a by-product of sheep farming; ***[2]***

(ii) *Award **[1]** for each of three distinct correct points in an explanation of the Natural House satisfies the three categories of triple bottom line sustainability **[3 max]** per category **[9 max]**.*
economic:
the house is built to make a profit;
wealth creation helps to promote economic growth;
this creates employment/increased revenue from taxes;

environmental:
the house is designed to minimize impact on the environment;
by using of natural materials;
it is energy-efficient and low carbon production;

socio-cultural:
traditional design but not based on a particular style/trend;
would fit into/be suitable for a wide variety of different locations;
can be easily adapted to suit local conditions/culture; ***[9]***