N11/4/DESTE/SP2/ENG/TZ0/XX/M

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MARKSCHEME

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DESIGN TECHNOLOGY

Standard Level

Paper 2

13 pages

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

Subject Details: Design Technology SL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A (total 20 marks) **ONE** question in Section B [20 marks]. Maximum total = 40 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.

SECTION A

1. (a) (i) *Award **[1]** for stating which innovation wave represents the beginning of the Industrial Revolution.*
first; ***[1]***

(ii) *Award **[1]** for stating the innovation wave which represents the use of automation in mass production systems.*
fourth; ***[1]***

(iii) *Award **[1]** per distinct point in a description of the pace of innovation represented by the five waves.*
each successive wave gets shorter;
showing that the pace of innovation is increasing; ***[2]***

(b) (i) *Award **[1]** for each distinct point in an outline of the production method used before 1785.*
craft/one-off;
created by human power/skill; ***[2]***

(ii) *Award **[1]** for identifying the technology from Table 1 which was the basis for the development of plastic materials and **[1]** for a brief explanation.*
petrochemicals;
most plastics are derived from oil; ***[2]***

(c) (i) *Award **[1]** for stating the technology from Table 1 which formed the basis for the development of the motor car.*
internal combustion engine; ***[1]***

(ii) *Award **[1]** per distinct point in a suggestion of why aviation is stated as an innovation beginning in the 1950s although the first aeroplane was invented in 1903.*
it was not until the 1950s that the aircraft industry was established as a successful commercial venture;
and so can be considered as an innovation;
on a global scale/due to design development of the original invention; ***[3]***

2. (a) *Award **[1]** for a definition of percentile range along the lines of*
that proportion of a population with a dimension at or less than a given value; ***[1]***

(b) *Award **[1]** per distinct point in an explanation of the limitations of using the 50^{th} percentile as a means of designing for the "average" person.*
the 50^{th} percentile refers to one particular dimension of the body;
a person may be average for one dimension but not for other dimensions;
e.g. the person may be average in height but not in arm length; ***[3]***

3. (a) *Award **[1]** for stating the type of material which can change from a fluid to a solid in a fraction of a second when exposed to an electric field.*
electro-rheostatic; ***[1]***

(b) *Award **[1]** per distinct point in an explanation of what is meant by smart materials.*
smart materials adapt in some way to changes in the environment in which they operate;
as one or more of their properties is altered by the changing conditions;
the property that can be altered influences the application of the smart material
e.g. a shape memory alloy which changes shape when heated to a certain temperature; ***[3]***

SECTION B

4. (a) (i) *Award **[1]** for stating one reason why Royal Dutch Shell supports the Envirofit stove.*
improve their image;
part of their corporate strategy;
moral/social responsibility;
corporate/social responsibility; ***[1 max]***

(ii) *Award **[1]** per distinct point in an outline of one reason why the stove may reduce in cost if it succeeds as an innovation.*
economies of scale;
if more stoves are sold the production costs per unit will be lower;

when enough units have been sold to recoup the fixed costs;
the price per unit can be reduced; ***[2 max]***

(iii) *Award **[1]** per distinct point in an outline of one reason why the metal alloy for the frame of the stove is likely to be nickel based.*
nickel-based alloys are particularly resistant to high temperatures;
which is one of the desired characteristics of the stove; ***[2]***

(b) (i) *Award **[1]** for stating the type of test that would be used in the design development stage of the stove to evaluate its reliability.*
performance test; ***[1]***

(ii) *Award **[1]** for each distinct point in a suggestion of one reason why the research and development costs for the Envirofit stove are so high.*
new technology to create an efficient conversion of energy from biomass;
and an alloy which conserves the heat well;
development of the technology to reduce the emissions from the stove;

complex problems;
requiring a team of specialists;
with much testing/pioneering strategy so little/no prior research; ***[3 max]***

(c) (i) *Award **[1]** per distinct point in an outline of one possible disadvantage of the Envirofit stove for its target market other than cost.*
user attitude;
users may be suspicious of the product;

tradition;
users may prefer to continue to use open-fire cooking as they are used to it;

availability;
the Envirofit stoves have to be distributed throughout the country but open-fire cooking is readily available;

maintenance;
users may not have the skill/ability/inclination to look after the equipment; ***[2 max]***

(ii) *Award **[1]** for each distinct point in a discussion of three advantages of the Envirofit stove compared to open-fire cooking **[3 max]** for each advantage.*
energy efficiency;
the Envirofit stove is efficient at conserving heat;
while open-fire stoves allow most of the heat to be wasted;

pollution;
open-fire stoves cause a great deal of pollution;
the Envirofit stove reduces the amount of pollution considerably;

conservation of resources;
open-fire cooking uses mostly wood by cutting down trees;
the Envirofit stove uses biomass which does not rely entirely on wood;

safety;
many accidents occur with open-fire cooking;
but with the Envirofit stove the user does not come into contact with flames; ***[9 max]***

5. (a) (i) *Award **[1]** for a definition of ductility along the lines of:*
the ability of a material/metal to be drawn/extruded into a wire/ extended shape; ***[1]***

(ii) *Award **[1]** per distinct point in a suitable outline of one reason for the application of a surface finish to steel other than aesthetics.*
protection;
steel is a ferrous metal which will rust / oxidise when in contact with moisture; ***[2]***

(iii) *Award **[1]** per distinct point in a description of how the tensile strength of a metal is increased by alloying.*
an alloy is a mixture of at least two materials one of which is a metal;
the tensile strength of the base metal can be increased by mixing it with a material of greater strength;

e.g. steel is a mixture of iron and carbon;
the percentage of carbon added to iron dictates the tensile strength of the alloy; ***[2 max]***

(b) (i) *Award **[1]** for stating the most likely scale of production for the table.*
batch; ***[1]***

(ii) *Award **[1]** per distinct point in an explanation of why the design of the MK2 steel table may contribute to a green design policy.*
it reduces the need to purchase three different products;
and so helps to conserve material resources;
less waste/pollution in manufacture; ***[3]***

(c) (i) *Award **[1]** per distinct point in an outline of one reason for including a factor of safety in the design of the MK2 table.*
a factor of safety means that the table has been designed to take higher loads than normally expected;
the table may be used/abused in a way not expected *e.g.* standing on it; ***[2]***

(ii) *Award **[1]** for each distinct point in a discussion of the use of plywood for the MK2 table in relation to the product life cycle **[3 max]** for each discussion issue.*
plywood can be manufactured with different surface veneers to resemble natural timber;
but the veneers will be quite thin;
so easily damaged and reducing the life cycle;

plywood can be treated with a surface finish/varnish/polish;
in order to make the plywood more durable/resist scratches;
if the surface finish is well maintained the life cycle will be lengthened;

plywood edges are vulnerable to damage/scuffing;
as the layers of the plywood veneers become exposed;
causing the table to lose its aesthetic appeal/become obsolete;

the glue used in the construction of plywood may deteriorate over time;
especially with large changes in temperature/contact with moisture;
gaps will occur between the veneers reducing the life cycle; ***[9 max]***

6. (a) (i) *Award **[1]** for stating which of the Navibot's fixed costs is most likely to be the highest.*
research and development (R&D); ***[1]***

(ii) *Award **[1]** for each distinct point in an outline of one physical property important for the material used to manufacture the casing of the Navibot.*
hardness;
so the casing does not scratch easily when bumping into objects in the home;

density;
the cleaner should not be too heavy as it will be carried around the home by users; ***[2 max]***

(iii) *Award **[1]** for each distinct point in a description of the idea generating technique used to decide the name of the Navibot.*
analogy;
as the name is derived from navigation and robot; ***[2]***

(b) (i) *Award **[1]** for stating the product life cycle stage of the Navibot.*
early; ***[1]***

(ii) *Award **[1]** per distinct point in a suitable discussion of the potential life cycle of the Navibot.*
the cleaner contains sensitive electronic components;
which could become damaged in use by bumping into objects left around the room (*e.g.* toys, wine glasses);
and reduce the life cycle considerably;

if the cleaner becomes scratched/scuffed;
by coming into contact with objects in the room;
the user may discard it because it looks scruffy even though it still works;

there may be pets in the house;
who treat the cleaner as a toy/attack the cleaner;
and reduce its life cycle;

the cleaner may not be easy to repair;
due to the electronic components;
and so is replaced rather than repaired;

planned obsolescence;
the consumer may be attracted to a new model of cleaner;
and so buys a replacement even though the old model still works;

cleaning environment;
the cleaner may not cope with all the types of surface cleaning required;
leading to its replacement/malfunction; ***[3 max]***

(c) (i) *Award **[1]** per distinct point in a description of the Navibot as an example of radical and incremental design.*
it is radical because it uses new technology for a vacuum cleaner/looks very different to a conventional cleaner;
but is incremental in that it does the same job as a conventional cleaner; ***[2]***

(ii) *Award **[1]** per distinct point in a discussion of three limitations of the Navibot as a potential successful innovation **[3max]** for each limitation discussed.*

cost;
the cleaner is an expensive item compared to other cleaners;
consumers may not be able/willing to pay for it;

consumer awareness;
potential consumers may not be aware of the product;
unless it is available in retail outlets which sell vacuum cleaners;

consumer reluctance;
some consumers may be suspicious of the new technology/shape;
and prefer to use a conventional cleaner instead;

pets;
if left alone in the house when the cleaner is operating;
pets may become alarmed by it;

type of household;
if there are lots of different levels/stairs in the house;
the cleaner may not be suitable to navigate them without help;

children;
might consider the cleaner a toy;
and injure themselves while playing with it;

ease-of-maintenance;
the cleaner has sensitive electronics;
not easy to repair/expensive to repair; ***[9 max]***