N05/4/DESTE/HP2/ENG/TZ0/XX/M+

MARKSCHEME

November 2005

DESIGN TECHNOLOGY

Higher Level

Paper 2

12 pages

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

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.

General

A markscheme often has more specific points worthy of a mark than the total allows (especially for essay questions). This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).
- An alternative answer or wording is indicated in the markscheme by a '/'; either wording can be accepted.
- Words in (…) in the markscheme are not necessary to gain the mark.
- The order of points does not have to be as written (unless stated otherwise).
- If the candidate's answer has the same 'meaning' or can be clearly interpreted as being the same as that in the mark scheme then award the mark.
- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have not achieved or what they have got wrong.
- Remember that many candidates are writing in a second language; be forgiving of minor linguistic slips. Effective communication is more important than grammatical niceties.
- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalised. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with **'ECF'**, error carried forward.
- Units should always be given where appropriate. Omission of units should only be penalised once. Indicate this by **'U-1'** at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.
- 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:*

Area of screen in Figure 2 = 1050 sq mm;
*Award **[0]** if no units are given.* ***[1]***

(ii) *Award **[1]** for:*
5.77 cm; ***[1]***

(iii) *Award **[1]** for identifying percentile and **[1]** for the calculation.*

female 5^{th} percentile data is 33°;
the designer would use this as it would then be OK for anyone to reach; ***[2]***

(b) (i) *Award **[1]** for each distinct limitation from the list below **[2 max]**.*

each design problem is unique;
all data is a simplification of a complex set of issues;
could be argued – better studied empirically;
on rig not actually pressing down on buttons or pads; ***[2 max]***

(ii) *Award **[1]** for each distinct point from the list below **[2 max]**.*

buttons need to be smaller because of larger screen;
space between the buttons needs to be less;
the buttons could be made higher to make them easier to distinguish;
buttons on the left for left hand thumb use; ***[2 max]***

(c) (i) Ergonomics is the application of scientific information concerning the relationship of human beings to the design of objects, systems and environments; ***[1]***

(ii) *Award **[1]** for each distinct factors which may influence a potential buyer when choosing a phone product **[3 max]**.*

how they perform;
the way they feel;
fashion statement;
how heavy;
tactile considerations;
colour;
brand;
network;
cost;
range of functions;
size;
battery life; ***[3 max]***

(d) (i) product was made in month 5 (May) 2004 (04); ***[1]***

(ii) *Award **[1]** for any distinct point.*

the names of the designers;
the recycling category;
the length of production run;
the registered design number;
material used;
month and year of production; ***[1 max]***

(iii) *Award **[1]** for each distinct point in a list.*

if there was a need to recall the product, the manufacturer can see exactly when the product was manufactured;
for recycling purposes the material used can be identified;
age of product identified for warranty; ***[2 max]***

(e) (i) Anthropometric data provides the designer with data concerning sizes relating to fingers and hands of potential users. ***[1]***

(ii) *Award **[1]** for identifying injection moulding as the process and a further **[2 max]** for outlining process/properties.*

the cover would be made by injection moulding;

a mould would be produced by one off production;
the body would be produced from thermoplastic;
plastic melted and forced into the mould;
mass production scale of production;
no finishing required; ***[3]***

2. (a) *Award **[1]** for a definition to the effect of*

a fractional increase in dimensions (length, area or volume) per degree Kelvin when an object is heated; ***[1]***

(b) *Award **[1]** for each distinct appropriate point in an explanation **[3 max]**.*

railway lines expand in length when heated;
this must be accounted for appropriately by providing expansion joints;
otherwise the lines will buckle and can compromise safety; ***[3]***

3. (a) *Award **[1]** for each distinct point in an appropriate description of sintering **[2 max]**.*

applying heat and pressure to a powder in a mould so that the powder fuses to take the shape of the mould;
the particles do not completely liquefy; ***[2]***

(b) *Award **[1]** for each of two advantages from the list below **[2 max]**.*

no surface finishing required;
suitable for high melting point materials;
clean technology;
can be used to produce intricate shapes; ***[2 max]***

4. (a) *Award **[1]** for a definition to the effect of*

the introduction, growth, maturity and decline of a product and its general pattern of production and profitability; ***[1]***

(b) *Award **[1]** per distinct point in an appropriate explanation **[3 max]**.*

design cycle is part of a product cycle as need is generated and this initiates the product cycle;
designer not necessarily in control of product life cycle – this may be the manufacturer;
designer needs to work as part of a team with manufacturer, distributors, retailers, production engineers, accountants; ***[3]***

5. (a) *Award **[1]** for a definition to the effect of*

an approach to manufacturing or production that uses less resources and causes less environmental damage than an alternative means with which it is economically competitive; ***[1]***

(b) *Award **[1]** per distinct appropriate point in an explanation of **one** way in which quantitative data on pollution and waste are used to support legislation relating to cleaner manufacture.*

relevant data can be used to monitor and check levels *e.g* of air or water pollution;
if the level of the pollutant exceeded the legislative limit then the manufacturer would have to react appropriately to avoid being fined;
the manufacturer can collect the data to ensure that they keep within the legislative limit;
the data can be collected by agency enforcing the legislation;
initial data can be used to provide evidence of the need for legislation; ***[3 max]***

6. (a) *Award **[1]** for each distinct point in a brief description of the structure of* Kevlar® *(aramid) fibre, **[2 max]**.*

linear chains of hydrocarbon rings;
behave like rigid rods aligned along the length of the fibre during manufacturing; ***[2]***

(b) *Award **[1]** for each reason from the list below of why* Kevlar® *(aramid) fibre is used in high performance yacht sails.*

Kevlar® (aramid) fibres do not absorb water;
Kevlar® (aramid) fibres have high tensile strength;
Kevlar® (aramid) fibres are light; ***[2 max]***

SECTION B

7. (a) (i) tough;
aesthetics; ***[1 max]***

(ii) *Award **[1]** for any one disadvantage identified and **[1]** for outlining why it is a disadvantage **[2 max]**.*

potential safety hazard;
if not fire retardant;

in disposal;
can be toxic and cause pollution;

low density foam;
can become misshapen with use; ***[2 max]***

(iii) nylon is more hard wearing than cotton;
but is less absorbent than cotton;
and is cheaper; ***[3]***

(b) *Any one factor suitably explained **[3 max]**.*

suitable anthropometric data;
based on the 50^{th} percentile;
needs to be used to obtain the right dimensions for the chair;

suitable anthropometric data;
based on the 50^{th} percentile;
needs to be used to design the chair suitable for sitting and reclining;

suitable anthropometric data;
based on the 50^{th} percentile;
needs to be used to ensure the chair is easy/safe to get in and out of;

comfort is a factor;
which should take into account posture;
and texture of the material;

weight of users;
needs to be taken into account to ensure the chair is in balance;
both as a seat and a recliner; ***[3 max]***

(c) *Award **[1]** for any consideration identified and **[1]** for the further details.*

possible finger traps;
between base and end parts;

possible sharp edges;
to laminations;

possible danger to children/pets;
sitting on the floor and getting hit by the moving chair; ***[2 max]***

(d) Young's modulus is the relationship of stress to strain;
the material must be strong enough to withstand the load;
and stiff enough not to deflect too much;
different materials have different Young's Modulus;
the material for the chair should not be too stiff;
as a certain amount of flexibility is required for comfort;
calculation of Young's Modulus;
stress/strain;
allows the stiffness of a material to be measured;
in relation to tensile and compressive forces; ***[9 max]***

8. (a) moulding; ***[1]***

(b) (i) good thermal shock resistance; ***[1]***

(ii) *Award **[1]** for each advantage identified and **[1]** for suitable outline.*

hard material;
so resists scratches;

smooth finish possible;
so good for aesthetics;

suitable for moulding;
so cost effective; ***[2 max]***

(c) (i) the distance between the load and the pivot is called the moment arm;
the lamp pivots on its base;
and the load is applied to adjust the head; ***[3]***

(ii) an external load is applied by a person to adjust the lamp head;
the lamp has a body load;
an external load gives rise to internal forces within the structure;
so that equilibrium is maintained; ***[4]***

(d) the bird shape has been simplified (made more abstract);
to create a balanced (stable) structure;
the "body" of the lamp needs to be sleek (smooth);
so the wiring is hidden (discreet);
and no controls are visible;
to interrupt the flow of the shape;
it's important to be able to adjust the height of the lamp;
but the mechanism is concealed in the head;
the wheels in the base are not visible;
but they help the function by allowing the lamp to be easily moved around the work surface; ***[9 max]***

9. (a) (i) *Award **[1]** for each point.*
does not rust;
good aesthetics;
tough;
cleans easily; ***[1 max]***

(ii) decorative patterning;
polygon shape;
different materials used to contrast with each other; ***[3]***

(b) the plastic has a cross-linked atomic structure of bonds;
which gives it a rigid 3D structure. Once heated the cross-linking of the bonds becomes permanent and hardens the plastic;
further application of heat will not cause the bonds to re-arrange so the plastic will not be affected by heating the water; ***[3]***

(c) handle for Kettle A:
when pouring, steam will easily come into contact with the handle;
as it will be necessary to grip the handle near the spout end;
wood does not conduct heat;

handle for Kettle B:
the design of the handle means that the hand is nowhere near the spout;
and will not be affected by water vapour;
plastic is a poor conductor; ***[4 max]***

(d) the thermosetting plastic is a good insulating material;
and so saves energy by reducing heat loss;
the kettle is easily moulded into shape;
which reduces energy in manufacturing;
the kettle has a thermostat;
which automatically turns off the kettle after the water has boiled;
and so saves on energy;
the kettle has a water indicator;
which shows how much water is in the kettle;
and so energy can be saved by only boiling enough water for user’s needs; ***[9 max]***