

MARKSCHEME

May 2005

DESIGN TECHNOLOGY

Standard Level

Paper 2

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Subject Details: Design Technology SL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A (total 20 marks) **and any ONE** question in Section B (20 marks each). Maximum total = 40 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 penalize 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 maximum horizontal spacing between crush barriers from Table 1, [1 max].*
- 3.1 m; *[1 max]*
- (ii) *Award [1] for stating one reason why (c) is a less suitable position for the crush barrier than (a) or (b), [1 max].*
- placing the barrier post in the centre of the step means that the space either side of the barrier is not wide enough to be used by a spectator so effectively a step is wasted reducing the capacity of the stand; *[1 max]*
- (iii) *Award [1] for identifying the correct values and [1] for getting the right answer, including units [2 max].*
- $3.1/380 = 8.16$;
therefore 8 steps between each barrier; *[2 max]*
- (iv) *Award [1] for identifying an appropriate reasons why additional guarding must be provided on the crush barriers if children are allowed into the standing area and [1] for a brief explanations [2 max].*
- children are shorter than adults so 1.1 m on a child will not put the pressure on a part of the body better able to withstand pressure but on their heads; this could lead to serious injury; *[2 max]*
- (b) (i) *Award [1] for identifying the correct value for the area behind the crush barriers available to spectators and [1] for getting the right answer, including units [2 max].*
- $14 \times 24.8 \times 5$;
 1736 m^2 ; *[2 max]*
- (ii) *Award [1] for identifying the correct value for the maximum capacity of the stand and [1] for getting the right answer, including units [2 max].*
- $(1736 \div 47)/10$;
8159.2, *i.e.* 8159 people; *[2 max]*
- (iii) *Award [1] for identifying the correct value for the maximum capacity of the stand and [1] for getting the right answer, including units [2 max]. Candidates should carry forward the value from (b) (ii) for the capacity of the stand.*
- $8159/660$;
12.36, *i.e.* 13 turnstiles; *[2 max]*

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

the ability of a material to withstand pulling forces;

[1 max]

- (b) Award **[1]** for identifying an appropriate design context in which tensile strength is an important consideration and **[1]** for each distinct correct point in an explanation **[3 max]**.

tensile strength is an important consideration for climbing ropes/elevator/lift cables;

where the rope/cable has to resist pulling forces from the weight of the person or the lift cage plus the person riding the lift;

if the material does not have a high enough tensile strength it will stretch and eventually will break once the force exceeds the ultimate tensile strength;

[3 max]

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

The most efficient way of designing and producing a product from a manufacturer's point of view;

[1 max]

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

Total cost = variable costs plus a proportion of the fixed costs;

Fixed costs are paid out before production starts and include the capital costs to set up production;

The proportion of the fixed costs depends upon the breakeven point determined by the manufacturer;

[3 max]

SECTION B

4. (a) (i) *Award [1] for a definition to the effect of.*
- the observation and analysis of comments made by people who have used a particular product; **[1 max]**
- (ii) *Award [1] for identifying one reason why designers use a variety of different drawing techniques to represent ideas and [1] for a brief explanation [2 max].*
- enables the collection of consumer responses to using the toothbrush;
identifies strengths and weaknesses of the design in practice; **[2 max]**
- (iii) *Award [1] for identifying a disadvantage of a user trial in the evaluation of the electric toothbrush and [1] for a brief explanation [2 max].*
- users carry out tasks in different ways;
the results of the user trail may give contradictory results/biased results;

time consuming;
may delay product going to market; **[2 max]**
- (b) (i) *Award [1] for each distinct point in a brief description of the significance of stiffness in the selection of plastic materials for the body of the electric toothbrush and the switch cover [2 max].*
- the body of the toothbrush needs to be very stiff so that it maintains its shape during use;
the switch cover must not be stiff to allow it to deform and enable the switches to be pressed on and off; **[2 max]**
- (ii) *Award [1] for identifying a reason why fusing is an appropriate method of joining the two types of plastic and [1] for brief explanation, [2 max].*
- creates a waterproof seal;
this will prevent water accessing the electrical circuitry; **[2 max]**

- (c) (i) *Award [1] for identifying one way in which planned obsolescence will influence the design specification of the electric toothbrush and [1] for a brief explanation, [2 max].*

specification of materials;

materials will be bought to last long enough but not too long;

design the product so it has to be replaced if anything goes wrong;

make it that it cannot be repaired;

rechargeability of battery;

needs to be rechargeable up to product guarantee but not longer;

[2 max]

- (ii) *Award [1] for distinct point in each of reuse, repair and recycle [3 max] for each, [9 max].*

Reuse [3 max]

use of rechargeable batteries;

design the product so it can be disassembled to enable the parts to be reused;

use standard parts so that they can be reused the product breaks down;

Repair [3 max]

make the product of standard parts so they can be easily replaced;

design the product so it can be disassembled to enable repair;

use screws rather than rivets or adhesives to enable repair;

Recycle [3 max]

use recycled materials;

make it of materials that can be recycled;

clearly indicate the materials of which the product is made so they can be recycled;

design the product so it can be disassembled to enable different materials to be separated easily for recycling;

[9 max]

5. (a) (i) *Award [1] for definition to the effect of:*
the introduction, growth, maturity and decline of a product and its general pattern of production and profitability; **[1 max]**
- (ii) *Award [1] for identifying an appropriate stage where freehand drawings would be relevant, [1] for brief explanation [2 max].*
by analysing weaknesses/problems with the design of the ballpoint pen; the designer could develop and improve the design; **[2 max]**
- (iii) *Award [1] for identifying a reason why the ballpoint pen could be considered in the mature stage of its life cycle and [1] for a brief explanation, [2 max];*
well diffused into marketplace;
still selling well/no sign of any decline;
not a lot of changes being made to the design; **[2 max]**
- (b) (i) *Award [1] for one advantage and [1] for one disadvantage of injection moulding in the production of the ballpoint pen body [2 max].*
- Advantages**
no finishing required;
volume production;
clean technology/minimizes waste/only heat up material to be moulded so no energy wasted;
- Disadvantages**
high set up costs;
limitations as to size, shape; **[2 max]**
- (ii) *Award [1] for each of two mechanical properties that make a material suitable for injection moulding [2 max].*
thermal expansivity;
toughness;
ductivity; **[2 max]**

- (c) (i) *Award [1] for each distinct point in a description of how the symbol facilitates recycling [2 max].*

identifies the plastic material that the body is made of;
this means it can be matched with products of the same material for recycling; **[2 max]**

- (ii) *Award [1] for each distinct way and [1] for each distinct point in a brief explanation [3 max] for each of three ways in which proactive adoption of an environmental policy can enhance a manufacturer's profits [9 max].*

Savings on energy

Energy is a major expense for most businesses;
Reducing energy consumption reduced business expenditure;
Clean technologies use less energy and lead to financial savings;

Savings on raw materials

clean technologies used as part of an environmental policy use raw materials more effectively;
in reducing waste the costs associated with the wasted materials can be reduced;

Avoidance of fines for pollution

clean technologies generate less pollution and waste;
contravention of legislation can lead to imposition of fines;
adopting an environmental policy reduces the risk of fines for pollution;

Enhanced public image

general public more environmentally aware;
there is a market for green products;
a manufacturer adopting an environmental policy can use it as part of the marketing;

Manufacturer can build environmental issues into the business plan

the manufacturer can determine the time scales for the uptake of more environmentally friendly practices;
this leaves the manufacturer in control rather than being forced to become more environmentally friendly in a reactive fashion which can be much more expensive and can result in manufacturing down time while improvements are implemented;

[9 max]

6. (a) (i) *Award [1] for stating one drawing technique that could be used to communicate the proposals to the general public during public consultation [1 max].*

plan of development site;
freehand drawings/artist's impressions of development;
CAD;

[1 max]

- (ii) *Award [1] each for stating one advantage and one disadvantage of using physical models in the consultation process [2 max].*

Advantage

physical models are more easily understood by a non-technical audience and thus a physical model would be good for the public consultation process;

Disadvantage

good physical models are expensive to construct;
good physical models are time consuming to construct;

[2 max]

- (iii) *Award [1] for identifying a factor that would determine the spacing of the bollards and [1] for a brief explanation [2 max].*

close enough to prevent cars driving into the pedestrian area or into the shop (ram raiding);

if they are too far apart then cars could drive between them;

far enough apart to keep costs down;

if they are too close then they will be extremely expensive;

far enough apart to allow people to move easily between them as they access the shop;

if they are too close together then pushchairs and wheelchairs and trolleys will not be able to pass easily;

[2 max]

- (b) (i) *Award [1] for identifying a property that makes a material suitable for extrusion and [1] for a brief explanation:*

high toughness;

if a material were not tough then when extruded it would not resist the propagation of cracks;

high ductility;

a low ductility material would not be able to be plastically deformed during extrusion;

[2 max]

- (ii) *Award [1] for listing each of two advantages of extrusion from the list below, [2 max].*

volume production;

hollow shapes;

no finishing required;

consistent cross-section;

[2 max]

- (c) (i) *Award [1] for identifying one aspect of the design of the bollards which makes the suitable for use in public access areas, [2 max].*

corrosion-resistant material;
does not need treatment but will retain attractive appearance;

smooth , rounded texture – no sharp edges;
will not catch on clothes and cause damage to passers-by;

[2 max]

- (ii) *Award [1] for each distinct point plus [1] for each distinct point in an explanation [3 max] for each of how automation, batch production and craft production would be incorporated into the production and installation of the safety bollards [9 max].*

Automation

extrusion is automated volume production;
automation would result in the production of long lengths of cylindrical pipes;
the caps would also be produced by volume production probably by stamping from a sheet of the material;

Batch production

the pipes would be sliced into sections of appropriate length;
the caps would be fitted;
the caps would then be fused to the cylindrical sections;

Craft production

the installation of the bollards at the site is craft production;
the lower sections would be sunk into the ground and secured with bolts;
concrete would be put round the bollard to match the level to that of the paving around the bollards;
may be used to develop a prototype of the model;

[9 max]
