

MARKSCHEME

November 2003

DESIGN TECHNOLOGY

Standard Level

Paper 3

1. Follow the markscheme provided, do **not** use decimals or fractions and mark only in **RED**.
2. Where a mark is awarded, a tick (✓) should be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark.
3. Sometimes, careful consideration is required to decide whether or not to award a mark. Indeed, another examiner may have arrived at the opposite decision. In these cases write a brief annotation in the **left hand margin** to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking.
4. Unexplained symbols or personal codes/notations on their own are unacceptable.
5. Record subtotals (where applicable) in the right-hand margin against the part of the answer to which they refer next to the mark allocation. Do **not** circle sub-totals. Circle the total mark for the question in the right-hand margin opposite the last line of the answer.
6. Where an answer to a part question is worth no marks, put a zero in the right-hand margin.
7. For each Option: Add together the totals for each question in the Option and write it in the Examiner Column on the cover sheet.

Total: Add up the marks awarded and enter this in the box marked TOTAL in the Examiner Column on the cover sheet.
8. After entering the marks on the cover sheet check your addition of all marks to ensure that you have not made an arithmetical error. Check also that you have transferred the marks correctly to the front cover. **We have script checking and a note of all clerical errors may be given in feedback to all examiners.**
9. Every page and every question must have an indication that you have marked it. Do this by **writing your initials** on each page where you have made no other mark.
10. If a candidate has attempted more than the required number of Options within the paper, mark only the required number of Options in the order in which they are presented in the paper and ignore any excess material, regardless of its quality. Make a comment to this effect in the left hand margin.
11. A candidate can be penalized if he/she clearly contradicts him/herself within an answer. Make a comment to this effect in the left hand margin.

Subject Details: Design Technology SL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in each of **TWO** Options (total *[15 marks]*). Maximum total = *[30 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 penalized. 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 penalized 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.

Option A – Raw material to final product

- A1.** (a) *[2]* for reason with brief explanation.
cotton is very absorbent;
therefore, it is necessary to waterproof cotton;
e.g. by the use of silicone or other waterproofing treatment *[2 max]*
- (b) *[1]* per distinct point in an appropriate explanation.
luxury feel;
looks expensive;
supports lifestyle issues for users;

deadens noise for shower better than a nylon curtain;
other surfaces in bathroom need to be easily cleanable and often have poor acoustic properties;
nylon is not good in terms of sound deadening characteristics;

can be printed with more intricate designs;
therefore more attractive;
can fit in with other textiles in bathroom, *e.g.* curtains and towels for a total “designer” look; *[3 max]*
- A2.** (a) *[1]* for appropriate disadvantage, *[1]* for brief explanation .
there are a number of possible responses, e.g.
hard, non-absorbent surfaces;
can results in condensation;

safety issues;
glass is brittle and can crack and result in cuts; *[2 max]*
- (b) the raw materials for glass have a very high melting point;
to break down the ionic bonds; *[2 max]*

A3. [1] per distinct point, up to [4 max] for how and up to [2 max] for why.

how

iron ore to iron

[2 max]

iron ore is Fe_2O_3 with SiO_2 impurities;

iron is extracted from iron ore in a blast furnace to form pig iron;

limestone and coke are added to iron ore;

coke (C) is converted to carbon monoxide which reduces iron oxide to iron metal /

$3\text{CO} + \text{Fe}_2\text{O}_3 \rightarrow 2\text{Fe} + 3\text{CO}_2$;

limestone removes SiO_2 impurity by combining with SiO_2 to form slag /

$\text{CaCO}_3 + \text{CaO} + \text{CO}_2 \quad \text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$;

iron to stainless steel;

[2 max]

iron converted to steel in furnace by blowing oxygen through the molten metal;

chromium (18%) and nickel (8%) are added to steel to make stainless steel alloy;

why

stainless steel has good corrosion resistance;

stainless steel does not need to be finished;

stainless steel is aesthetically pleasing;

stainless steel has a good surface and is easy to keep clean and is hygienic;

[2 max]

Option B – Products in context

- B1.** (a) a crystal is a regular arrangement of particles;
the particles can be atoms, ions or molecules; *[2 max]*
- (b) as a substance reaches its melting point the particles of which it is composed break loose from the rigid lattice arrangement and move independently;
the material thus changes from solid to liquid, *i.e.* it melts; *[2 max]*
- (c) Kevlar can be manufactured as a fibre which can be twisted into ropes;
the fibres have a very high tensile strength;
Kevlar fibres are non-stretch and do not absorb water; *[3 max]*
- B2.** *[1] for each correct point.*
annotation to show yield stress correctly *i.e.* at end of elastic region where line starts to curve;
annotation to show UTS correctly *i.e.* at the level of maximum stress at the end of the plastic region; *[2 max]*
- B3.** *[1] per distinct point.*
Young's modulus relates to how a material responds to a load;
in the case of a fishing rod the load is the fish and the rod responds by bending;
a fishing rod is designed so that it responds differently to a stress along its length;
the furthest end is made very thin so that it bends in response to a load (the fish);
high Young's modulus;
the nearest end to the fisherperson is made much thicker and bends less;
low Young's modulus; *[6 max]*

Option C – Appropriate technologies

- C1. (a)** *[1]* for each distinct relevant point in brief explanation.
in the late 1980s there has been a growing number of “green” consumers wanting environmentally friendly products;
this constitutes a “market”;
the market provides an impetus for the development of new products that can demonstrate sustainability; *[2 max]*
- (b) *[1]* per distinct point for an appropriate description.
the ecolabel uses lifecycle analysis – “cradle to grave”;
whereas the energy rating label merely looks at energy consumption during use of the product; *[2 max]*
- (c) *[1]* for each distinct relevant point within explanation.
sustainable development involves trying to reduce energy utilization throughout life cycle;
reducing consumption of raw materials;
minimizing waste;
reducing pollution; *[3 max]*
- C2.** *[1]* for each correct distinct characteristic.
low in capital cost;
uses local materials whenever possible;
involves decentralized renewable energy sources;
local labour force;
creates jobs;
makes technology understandable to the people who use it;
flexible so that it can continue to be used or adapted to fit changing circumstances;
not detrimental to quality of life;
not detrimental to the environment; *[2 max]*
- C3.** *[1]* for each distinct point up to *[6 max]*. Up to *[3 max]* for need to conserve and up to *[3 max]* for means to conserve resources.
economic considerations in relation to set up costs for using renewables;
need to conserve resources
developed countries have established a dependency on consumption which is difficult to break;
non-renewable resources finite;
need to encourage use of renewables;
waste disposal into landfill sites a major problem
means to conserve resources
wind farms or solar panels require considerable investment;
built-in obsolescence versus longevity;
aesthetic versus function;
considerations of culture, values and attitudes;
legislative control can help to force considerations of resource conservation;
economic control can force consideration similarly; *[6 max]*

Option D – Food technology

- D1.** (a) *[1]* for each of any **two** organoleptic properties from the following.
flavour;
smell;
appearance;
texture;
sound; *[2 max]*
- (b) *[1]* per distinct point.
“adult” and “child” are particular market segments;
flavours tend to be more sophisticated for “adult” market, e.g. cheese and chives versus plain cheese flavour, paprika flavour;
texture of crisps / snack products may vary according to target market;
appearance, e.g. shapes of pieces, may be important for “child” market and may involve novelty shapes, e.g. dinosaurs or space craft; *[3 max]*
- D2.** *[1]* per distinct point.
oxidation of double bonds present in unsaturated fatty acids found in triglycerides;
results in formation of compounds (aldehydes and ketones) which give the fat off/tallowy flavours; *[2 max]*
- D3.** *[1]* per distinct point in brief explanation.
health consciousness relates to issues of low fat, low sugar, low cholesterol, high fibre;
new food products can be designed to achieve particular goals, e.g. “lite” products are low in fat or low in sugar; *[2 max]*
- D4.** *[1]* for each distinct correct point.
selling raw materials for onward processing returns a low income to the farmer;
processing raw products on the farm results in higher value consumer-ready products;
and gives farmers the opportunity to retain income;
and enhance farm sustainability;
farmers are thus able to capture a larger share of the food dollar;
on-farm processing creates local jobs;
and circulates income in the local economy; *[6 max]*

Option E – Computer aided design and manufacturing

- E1.** (a) *[1] per distinct point.*
two axes perpendicular to each other are available – X and Z / R and Z;
the axes reflect the movement of the tools that results in shaping of the lathed pieces; *[2 max]*
- (b) *[1] for problem and [1] for brief explanation.*
wood is a natural composite, and inherently non-uniform;
the grain varies which makes it problematic;
the wood has to be made cylindrical before it can be lathed;
so this involves considerable preparation work;
the wood chips / slivers clog up the machine;
and it has to be cleared at frequent intervals;
the machine needs to be regularly oiled;
else its life span is shortened; *[2 max]*
- (c) *[1] per distinct relevant point within explanation.*
graphics produced on a CAD system;
are translated to a set of programming coordinates;
which instruct the CNC lathe how to manufacture the design seen on the screen; *[3 max]*
- E2.** *[1] per distinct point.*
a digital camera is an example of an input device;
which can be used to input images into a CAD system for manipulation with the software; *[2 max]*
- E3.** *[1] for each distinct correct point.*
mass customization enables products to be customized to the requirements of the individual consumer;
examples of mass customized products include Barbie dolls and Nike trainers (other examples may be used);
defining characteristics which can be changed between different options, e.g. hair colour for a Barbie doll can be blonde, brown, black or auburn, or heel colour for a pair of Nike trainers within the limitations of the palette options;
the maths of the potential combinations becomes very large;
the customized product is generally sold at a premium price;
the customized product may be personalized by addition of name onto product; *[6 max]*

Option F – Invention, innovation and design

- F1. (a)** *[1]* for identifying a safety issue and *[1]* for a brief explanation.
the user can come in contact with electrical element;
so there is the potential for electric shock;
the user can come in contact with hot parts;
so could be easily burnt as they insert and remove toast from the machine; **[2 max]**
- (b)** *[1]* for identifying an appropriate technological advance that has enabled the reinnovation of the toaster and *[1]* per distinct point for an explanation.

advances in materials, e.g. advances in the nature of plastics;
has enabled enhanced range of colours;
and enhanced recycling potential;

advances in manufacturing processes, e.g. CAD/CAM;
has enhanced range of shapes, surface detail possible;
and enhanced design possibilities; **[3 max]**
- F2.** *[1]* per distinct point.
one aspect of the ongoing design of the toaster has been to enhance the energy efficiency of the toaster;
and to make it toast more evenly with less user intervention;
fashion has played a major role in design of the toaster;
e.g. in making toasters to match kitchen styles/colours/other appliances,
e.g. kettle, saucepans; **[2 max]**
- F3.** *[1]* per distinct point.
a new concept coming onto the market does not have any competition;
and therefore the corporation adopting a pioneering strategy can “clean up” i.e. command a high price which the market will pay due to little or no competition, potential for big profits before the competition gets on the market;
however, this strategy is high risk if the market is not ready at the current time or price; **[2 max]**
- F4.** *[1]* per distinct point, **[3 max]** for economic demands and **[3 max]** for social demands.
economic demands
financial success important, i.e. product finds market and sells well in market;
creating the invention of the toaster was relatively inexpensive;
developing ideas into the marketable product is much more expensive;

social demands
an innovation is rarely very important to society and for it to have any significance it has to be adopted by a large number of individuals and/or organizations;
product needs to fulfill social need to be successful;
product needs to be consistent with existing values, skills and past experiences of potential customers to be successful; **[6 max]**

Option G – Health by design

- G1.** (a) *[1] per distinct relevant point for brief explanation.*
in vitro and *in vivo* tests first on animals and then on humans;
for a range of adverse reactions;
(specifically cytotoxicity, haemolysis, irritation, sensitisation, intracutaneous reaction,
systemic toxicity, implantations, genotoxicity, sub-chronic toxicity, carcinogenicity,
reproduction toxicity, names not required); **[2 max]**
- (b) *[1] per distinct relevant point in explanation.*
Pro Osteon can be shaped to fill bone defects of varying shapes;
the pore structure of Pro Osteon is very similar to human bone;
and provides a matrix through which blood vessels and new bone tissue can grow;
thus, the implant acts as a temporary trellis; **[3 max]**
- G2.** *[1] for naming each appropriate material.*
polyester;
nylon;
paraffined silver tubes; **[2 max]**
- G3.** *[2] for appropriate outline.*
if the person wears glasses;
behind-the-ear aids would be unsuitable;
if the person has difficulty handling small objects, *e.g.* due to arthritis;
a behind-the-ear aid would be most suitable;
in-the-canal and in-the-ear users will find using the phone difficult due to feedback;
whereas a completely-in-canal aid can be used with a phone; **[2 max]**
- G4.** *[1] for each relevant point, up to [3 max] for issues related to reducing atmospheric pollution and up to [3 max] for noise pollution and traffic congestion.*
motor cars pose significant threats to human health
- increased atmospheric pollution;
- noise pollution;
- stress of traffic congestion;

electric vehicles can potentially address issues of increased atmospheric pollution and noise pollution;
atmospheric pollution is caused by burning of fossil fuels and can result in poor air quality leading to asthma, bronchitis and various pneumoconioses;
obtaining electricity from renewable sources, *e.g.* hydroelectric power or solar energy;
would avoid the burning of fossil fuels;

electric vehicles are quieter than ones powered by engines burning fossil fuels;
so reducing noise pollution;
electric vehicles will have no impact on stress of traffic congestion; **[6 max]**

Option H – Electronic products

- H1.** (a) *[1] per distinct relevant point.*
accepts input value from sensors, in this case (s1 – s8) which are fuzzified;
rules are evaluated from the fuzzified input to output computed truth values;
defuzzification steps translates truth values into crisp output; *[3 max]*
- (b) *[1] for identifying an appropriate benefit, [1] for brief explanation.*
maximize traffic flow;
so that drivers will be kept waiting for the minimum time; *[2 max]*
- H2.** *[1] for identifying the importance and [1] for brief explanation.*
feedback provides the inputs for fuzzification;
thus the traffic lights will change according to the prevailing traffic conditions;` *[2 max]*
- H3.** *[1] for identifying an appropriate sensor and [1] for brief description.*
any non-contact sensor;
could count cars as they pass the sensor; *[2 max]*
- H4.** *[1] for each distinct relevant point.*
hard-wired systems are designed and realized through building the circuit using physical components;
whereas software-controlled programmable systems are produced virtually;
testing of programmable circuits can be done virtually;
so that modifications to the design to meet the specification can be done quickly;
thus saving time;
and virtually;
without wasting physical components;
software solutions can allow easy tuning of the fuzzy logic; *[6 max]*
-