

# **MARKSCHEME**

**May 2003**

## **DESIGN TECHNOLOGY**

**Standard Level**

**Paper 3**

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

## General Marking Instructions

*After marking a sufficient number of scripts to become familiar with the markscheme and candidates' responses to all or the majority of questions, Assistant Examiners (AEs) will be contacted by their Team Leader (TL) by telephone. The purpose of this contact is to discuss the standard of marking, the interpretation of the markscheme and any difficulties with particular questions. It may be necessary to review your initial marking after contacting your TL. **DO NOT BEGIN THE FINAL MARKING OF YOUR SCRIPTS IN RED INK UNTIL YOU RECEIVE NOTIFICATION THAT THE MARKSCHEME IS FINALIZED.** You will be informed by e-mail, fax or post of modifications to the markscheme and should receive these about one week after the date of the examination. If you have not received them within 10 days you should contact your Team Leader by telephone. Make an allowance for any difference in time zone before calling. **AEs WHO DO NOT COMPLY WITH THESE INSTRUCTIONS MAY NOT BE INVITED TO MARK IN FUTURE SESSIONS.***

You should contact the TL whose name appears on your “Allocation of Schools listing” sheet.

**Note:**

Please use a personal courier service when sending sample materials to TLs unless postal services can be guaranteed. Record the costs on your examiner claim form.

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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) *Award [2] for reason with brief explanation.*  
weakly bonded pairs of electrons;  
can move freely through the structure are very low temperatures; *[2 max]*
- (b) *Award [1] per distinct point in an appropriate explanation.*  
you would not need either the liquid helium tank or the liquid nitrogen tank to maintain low temperatures;  
therefore, you would not need the refrigerator (because you would not have to reliquefy the liquid helium);  
the frame could be less substantial as it would have to support less weight; *[3 max]*
- A2.** *Award [1] for appropriate chemical modification, [1] for brief explanation.*  
*Possible responses are:*  
addition of flavouring agents, e.g. meat flavour, chicken flavour, herbs, spices;  
to simulate the taste of traditional meat products;  
addition of colouring agents;  
to simulate the appearance of traditional food products;  
addition of binding agents;  
to ensure that the product retains its shape appropriately through processing, cooking and serving; *[2 max]*
- A3.** *Award [1] for appropriate chemical modification, [1] for brief explanation.*  
thermal shock resistance is enhanced (the product can be used in cooking e.g. taken out of oven and put into water for cleaning);  
by increasing the  $B_2O_3$  content; *[2 max]*
- A4.** *Award [3 max] for how and [3 max] for characteristics / composition.*  
*how?*  
spinning fibres into yarn results in a composite yarn comprising nylon and cotton;  
yarn can then be knitted into fabric to give fabric with lateral flexibility;  
weaving fabric results dimensional stability which does not accommodate the diversity of shapes of feet;  
  
*composition / comfort and durability*  
cotton fabrics are more absorbent;  
therefore, more comfortable for (sweaty) feet;  
nylon is more hardwearing;  
but less comfortable;  
could use nylon-enriched cotton yarn throughout to enhance durability;  
could just reinforce areas subject to wear, e.g. heels and toes; *[6 max]*

**Option B – Microstructures and macrostructures**

- B1.** (a) linear chain molecules (sometimes with side bonding of the molecules);  
weak secondary bonding between the chains; *[2 max]*
- (b) *[1] per distinct relevant point.*  
heat enables the molecules to slide over one another (and stretched out along the hinge line);  
load must be high enough to get plastic deformation;  
molecules remain aligned along the hinge line on cooling; *[3 max]*
- B2.** overlap of outer electrons;  
shared between atoms; *[2 max]*
- B3.** *Award [1] for each correct point.*  
reversible effect of heat on thermoplastics;  
the molecules slide over each other in melting allowing thermoplastics to be reused; *[2 max]*
- B4.** *Award [1] per distinct point.*  
a stress/strain graph identifies the way a material responds to a load;  
the stress/strain graph will show a straight line section – the elastic region;  
this will then change to a curved line – the plastic region;  
if only enough force is exerted that the material remains in the elastic region then it will return to its original size and shape when the force is removed;  
thus the force has to be sufficient so that the material is in the plastic region and thus remains in the new shape once the force is removed;  
the force has to be greater than the yield stress to plastically deform the hinge;  
but less than the ultimate tensile stress to stop it fracturing; *[6 max]*

**Option C – Appropriate technologies**

- C1.** (a) *[1]* for definition to the effect of:  
resources that are naturally replenished in a short time/less time than one lifetime; *[1]*
- (b) *[1]* for definition to the effect of:  
technology appropriate to the context to which it is applied; *[1]*
- (c) *Award [1] for each relevant point within an explanation.*  
there are 300 sunny days per year in Nepal thus continuity of supply which is a common issue for exploiting solar energy is not a problem;  
availability of equipment facilitates exploitation;  
cheaper than using kerosene and LPG;  
labour saving;  
cleaner technology; *[3 max]*

**C2.** *Award [1] for each distinct relevant issue.*

*Possible responses are:*

- promoting sustainable energy development/use of renewables;
  - safe and environmentally sound transport systems;
  - industrial development that does not adversely impact the atmosphere;
  - agricultural (and forestry) development that does not adversely impact the atmosphere;
  - sustainable resource development and land use;
  - sustainable energy consumption patterns and lifestyles;
  - preventing stratospheric ozone depletion;
- [2 max]*

**C3.** *Award [1] for each correct distinct characteristic.*

- low in capital cost;
  - uses local materials wherever possible;
  - involves decentralized renewable energy sources;
  - local labour force;
  - creates jobs;
  - fits in with culture;
  - makes technology understandable to the people who use it;
  - flexible so that can continue to be used or adapted to fit changing circumstances;
  - not detrimental to quality of life;
  - not detrimental to the environment;
- [2 max]*



**C4.** *Award [1] per distinct relevant point.*

the solar cooker liberates Nepalese people from the drudgery of collecting fuel wood which can involve them in long treks;

the solar cooker is simple to use;

the solar cooker is controlled by human beings not the reverse;

the use value of the solar cooker is more than its exchange value;

the solar cooker provides mutually non-exploitative relationships with developed countries;

the solar cooker meets the cultural, historical and other requirements of those who build and use it;

there are no moving parts in the solar cooler so it is high durability and repairability;

the solar cooker can be designed for disassembly so that the parts can be reused and recycled;

the financial costs for using the solar cooker are minimal throughout its lifecycle;

***[6 max]***

**Option D – Food technology**

- D1.** (a) *Award [1] for identifying appropriate lifestyle factor and [1] for brief explanation.*  
employment status, e.g. working women pressure on time no time;  
to bake bread traditionally so bread-maker enables home-baked bread without all the hassle;  
health consciousness;  
the bread-maker enables people to make bread according to their favoured health recipes;  
reduced mobility;  
people can have fresh bread daily without going to shops;  
leisure activities;  
lots of people like cooking as a leisure activity, the bread-maker enables people to experiment with different recipes;  
back to basics;  
the bread-maker allows bread-making at home;  
technophiles love buying gadgets; **[2 max]**
- (b) *Award [1] per distinct point.*  
the bread-maker enables the one-off production of a loaf (it is effectively automated craft production);  
the crust of the bread is likely to be chewier and the texture will be less uniform than for mass produced bread;  
designer breads can be produced with a range of flavours and textures, e.g. walnut bread, banana bread; **[2 max]**
- (c) *Award [1] per distinct point.*  
Bread is rich in carbohydrates and vitamins;  
but it is not a complete food/cannot just eat bread alone;  
as it must be complemented with other (with protein rich foods and protective foods; **[3 max]**
- D2.** low dietary fibre intake is implicated in a number of diseases common in developed countries, e.g. constipation, large bowel cancer;  
eating foods rich in dietary fibre, e.g. brown rather than white bread, vegetables and fruit reduces the risk of these diseases; **[2 max]**
- D3.** *Award [1] per distinct point in brief explanation. [2 max] each for aeration, protein coagulation and gelatinisation.*
- aeration*  
occurs during proving and affects the density of the finished bread;  
aeration through the activity of yeast results in tiny pockets of carbon dioxide being formed in the dough;
- protein coagulation*  
occurs on cooking and sets the dough;  
so that on cooling the light aerated structure is retained;
- gelatinisation*  
occurs during kneading, proving and particularly during cooking;  
starch granules absorb water and are broken open reducing the grittiness of texture of uncooked starch; **[6 max]**

**Option E – Computer aided design, manufacture and production**

- E1.** (a) CAD software running on a PC = CAD, using the PC to control the embroiderer = CAM;  
the serial/parallel/USB interface/optical fibre/infrared connections on the PC can be used to connect CAD to CAM to produce CAD/CAM system; **[2 max]**
- (b) *Award [1] for input device and [1] for brief explanation.*  
a scanner is an input device;  
pictures, logos, etc. can be scanned into a computer programme and modified as necessary to output them in embroidered form; **[2 max]**
- (c) *Award [1] per distinct relevant point within the explanation.*  
the frame ensures accurate alignment of different parts of the embroidered pattern;  
and dramatically reduces the effects of fabric stretch;  
so that designs can be reproduced accurately on the fabric;  
the frame provides points of reference for the embroiderer/x and y coordinates to achieve the design; **[3 max]**
- E2.** *Award [1] per distinct point.*  
production to order with materials being supplied Just-in-time;  
saves on storage space;  
reduced capital investment;  
as capital is not tied up in unused raw materials or unsold products; **[2 max]**
- E3.** *Award [1] for each distinct correct point.*  
copyright is the right in law to be the only producer of a design;  
a patent is a government agreement giving someone the right to make or sell a new invention for a certain number of years;  
however, if a design is modified even slightly then it is a different design and not subject to copyright or patent;  
computerized equipment facilitates the copying of designs;  
sophisticated equipment enables reverse engineering (to study or analyse a design in order to learn details of its design, construction, and operation);  
once the design has been copied into CAD software then CAM facilitates the manufacture of the design;  
computerization has led to a different sort of crime (virtual crime);  
designs can be assessed from anywhere in the world via computer; **[6 max]**

**Option F – Invention, innovation and design**

- F1.** (a) *Award [1] for each distinct point.*  
the Walkman was a new product/radical design;  
there was no previous comparable product to imitate;  
there was no established market; *[3 max]*
- (b) *Award [2 max] for an appropriate outline.*  
many aspects of the design are the same or similar to what went before;  
difference is hidden technology; *[2 max]*
- F2.** Akio Morita, as Sony founder and honorary chairman, was an influential individual within the Sony organization;  
who had an enthusiasm for the Sony Walkman™ design;  
he pushed his idea against skeptical colleagues;  
he believed in his own vision;
- F3.** for re-innovation products and processes are constantly redesigned;  
this can overcome weaknesses in design;  
can make products more commercially viable;  
can incorporate new technologies/new materials; *[2 max]*
- F4.** *Award [1] per distinct point.*  
an imitative corporate strategy aims to develop a product similar to a successful “pioneered” product as quickly as possible;  
an imitative strategy takes advantage of research and development investment by other (pioneering) companies;  
an imitative corporate strategy costs less than a pioneering one;  
an imitative strategy is less risky than a pioneering one;  
an imitative strategy has the potential for smaller gains than a pioneering strategy;  
an imitative strategy is based on a strong development capability;  
an imitative strategy is more likely in an organization that has a low innovative potential;  
an imitative strategy is often more acceptable to management; *[6 max]*

**Option G – Health by design**

- G1.** (a) *Award [1] per distinct point for appropriate explanation.*  
the hearing aid shell have been typically hard shells and must therefore, fit the ear of the individual user perfectly;  
each ear is individual so the shell is made through moulding which is one-off production; **[2 max]**
- (b) *Award [1] for an appropriate disadvantage plus [1] for brief explanation.*  
if a person wears glasses;  
a BTE aid would be unsuitable;  
if a person has difficulty handling small objects, *e.g.* due to arthritis;  
a BTE aid would be most suitable;  
it is very visible;  
many people do not like to admit they need a hearing aid; **[2 max]**
- (c) *Award [1] per distinct relevant point.*  
smaller hearing aids are placed in the ear canal and thus closer to the ear drum;  
the closer the aid is to the drum the less amplification is required;  
less amplification means less drain on battery and thus extends battery life; **[3 max]**
- G2.** *Award [2] for appropriate outline.*  
new materials;  
better optical quality;  
increased comfort rating;  
more efficient for volume production;  
can meet the needs of different target markets;  
cheaper manufacture therefore more acceptable price for contact lenses; **[2 max]**
- G3.** *Award [1 max] for each distinct relevant point.*  
identifying an appropriate design context;  
user-centred design is a design methodology in which designers do not rely on their tacit knowledge of the user group but use users as a resource to increase their understanding of the design context;  
user-centred design is particularly applicable for use when designing for disabled people;  
in relation to designing for particular lifestyle issues;  
focus groups with groups of users;  
semi-structured interviews with individual users;  
can be used to collect data to develop the design specification;  
and to evaluate the design at different stages of the design cycle;  
and thus to inform the development of the product;  
the Internet can be invaluable for communicating with users;  
using e-mail or bulletin boards or chat room facilities; **[6 max]**

**Option H – Electronic products**

**H1.** (a) thermistor;

appropriate symbol e.g.  ; [2 max]

(b) 50 % cool;  
50 % warm; [2 max]

(c) *Award [1] for each correct point.*  
two rules will “fire up”, i.e. the one for temperature is cool and the one for temperature is warm;  
the rules will be defuzzified by an appropriate method, e.g. centre of gravity;  
this will give a crisp output value for the heater; [3 max]

**H2.** *Award [1] for brief explanation.*  
adding impurities to a semiconductor material such as silicon or germanium will alter the way in which current flows through the material;  
addition of elements (e.g. As, P, Sb) with five valence electrons;  
creates an n-type semiconductor;  
addition of elements with three valence electrons (e.g. B, Al, In and Ga);  
will create a p-type semiconductor; [2 max]

**H3.** *Award [1] for each distinct relevant point. It is quiet acceptable for the candidates just to use a diagram appropriately labeled. Up to [2 max] for overdamping and [2 max] for underdamping.*  
  
critical damping is the closest possible to ideal;  
the system will reach the desired position in the shortest possible time and with no oscillation;  
  
overdamping;  
occurs when excessive friction and/or a low gain amp is used;  
the system will take ages to reach the desired position if overdamped; [6 max]  
  
underdamping;  
occurs when the load has a high moment of inertia, a high gain amplifier or low friction;  
overshooting and oscillations will occur with underdamping; [6 max]

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