



# **MARKSCHEME**

**November 2004**

## **DESIGN TECHNOLOGY**

**Standard Level**

**Paper 3**

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## 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.***

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 [1] for each distinct point in an explanation of how nylon threads are manufactured from petroleum [3 max];*  
nylon is produced by the polymerization of adipic acid and a diamine;  
the two raw materials are dissolved in solvent and mixed in a controlled way;  
the fibres are extruded; **[3 max]**
- (b) *Award [1] for each appropriate response from the list below, [2 max];*  
non absorbent;  
desired characteristics, e.g. tensile strength, can be designed in;  
not susceptible to attack by microbes; **[2 max]**
- A2.** *Award [1] for a reason why wood is finished for use in the jewellery and [1] for a brief explanation.*  
enhancing its aesthetic properties;  
make it look more attractive, e.g. by using varnish;  
change its colour;  
to make it more decorative;  
to prevent it being discoloured during use;  
e.g. by sweat and grime; **[2 max]**
- A3.** *Award [1] mark for a reason why stainless steel is a suitable material for the manufacture of the clasps and [1] for a brief explanation [2 max].*  
good corrosion resistance;  
does not need to be protected with a finish;  
unreactive when in contact with skin;  
unlikely to cause an allergy; **[2 max]**
- A4.** *Award [1] mark per distinct point [6 max].*  
any product will not be commercially successful unless it can develop a market;  
public acceptability is key to commercial success;  
people are reluctant to taste new foods;  
the look, taste and smell of food gives an initial impression;  
people are more likely to eat foods that they are familiar with;  
making new products, e.g. mycoprotein, look and taste like existing food products  
makes them more likely to be tried by people;  
new food products are often introduced in ready meals;  
once people get used to the idea they can be released as separate ingredients; **[6 max]**

**Option B – Microstructures and Macrostructures**

- B1.** (a) *Award [1] for a brief description of Kevlar® fibres [2 max].*  
Kevlar® fibres comprise linear chains of hydrocarbon rings;  
they are aligned along the length of the fibre; *[2 max]*
- (b) *Award [1] for each correct response from the list below, [2 max].*  
very high tensile strength;  
very low elasticity;  
high stiffness; *[2 max]*
- B2.** *Award [1] mark per distinct point [2 max].*  
the outer electrons of some atoms come close enough to overlap and are shared between nuclei;  
each shared pair of electrons is called a covalent bond; *[2 max]*
- B3.** *Award [1] for each distinct point in an explanation of the behaviour of particles during melting, [3 max].*  
in a solid the particles are closely packed in a lattice structure;  
as the temperature rises the oscillation of the particles around a fixed point increases;  
at the melting point they gain sufficient energy to move from their fixed position; *[3 max]*
- B4.** *Award [1] for each distinct point in an explanation of how grain size can be controlled and modified by the rate of cooling of a molten metal [6 max] total;*  
slow cooling allows larger grains to form;  
rapid cooling results in smaller grains;  
directional properties result from selectively cooling one area of a metal;  
reheating a solid allows material to diffuse between neighbouring grains and the grain structure to change;  
larger grains result in a metal with increased tensile strength and hardness;  
smaller grains result in a metal with decreased tensile strength and hardness; *[6 max]*

**Option C – Appropriate Technologies**

- C1.** (a) *Award [1] for an issue that contributes to the feasibility of recycling and [1] for a brief explanation [2 max].*  
economics;  
it can be very expensive to recycle/virgin raw materials may be cheaper than recycled materials;  
consumer resistance to using waste-based products;  
can make it that there is not a market for products made of some recycled materials; **[2 max]**
- (b) *Award [1] per distinct point in an appropriate description.*  
as people have become more aware of the issue of global warming there has been an increasing number of “green” consumers;  
this has created “market pull”; **[2 max]**
- (c) *Award [1] for each distinct point in an explanation of how Extended Producer Responsibility will contribute to reduction in the exploitation of resources [3 max].*  
manufacturers having to take back products will have to find something to do with them;  
it will encourage them to manufacture products to make it easier to recycle them;  
they will be encouraged to select materials with lower environmental impact as it will cost them more to buy and dispose of higher environmental impact materials; **[3 max]**
- C2.** *Award [1] mark for each of two responses from the list below, [2 max].*  
low in capital cost;  
uses local materials wherever possible;  
creates jobs (employing local skills and labour);  
involves decentralized renewable energy sources;  
makes technology understandable to the people who use it;  
are flexible so they can continue to be used to fit changing circumstance;  
are not detrimental to the quality of life or the environment; **[2 max]**
- C3.** *Award [1] mark per distinct point [6 max].*  
**designing products for ease of disassembly;**  
so it makes it easy to recycle parts and materials from obsolete products;  
e.g. using screws rather than rivets for joining components;  
  
**using standard parts in the manufacture of products;**  
this makes it more worthwhile taking out parts for reuse;  
non-standard parts would need to be made of material that can be economically recycled; **[6 max]**



**Option D – Food Technology**

- D1.** (a) *Award [1] for each of two factors that influence the ease of microbial spoilage [2 max].*  
pH/acidity;  
a<sub>w</sub>/water activity;  
nutrient content;  
temperature; **[2 max]**
- (b) *Award [1] per distinct point in an appropriate description.*  
canning extends the safe storage life of tomatoes by:  
killing microorganisms with heat;  
preventing recontamination of the food by the food packaging – the can; **[2 max]**
- (c) *Award [1] for identifying an organoleptic property of tomatoes affected by canning and [1] for a brief explanation.*  
texture;  
canning affects the cellular structure and softens the tomato;  
smell;  
canning gives the tomatoes a cooked smell;  
taste;  
canning gives the tomatoes a cooked taste;  
appearance;  
canned tomatoes lose their shape as the texture softens;  
sound;  
fresh tomatoes would make a different sound when bitten into or cut; **[2 max]**
- D2.** *Award [1] mark per distinct point [3 max].*  
processing increases the value of food commodities;  
if the farmer sells these higher value products to consumers then a larger share of the “food dollar” remains on the farm;  
processing the jobs creates jobs for local people and circulates more money in the rural economy; **[3 max]**
- D3.** *Award [1] for each distinct point explaining how nutritional requirements change, [3 max] and [1] for each distinct point explaining how food choice changes as a person gets older, [3 max], [6 max total].*  
**how nutritional requirements change as a person gets older [3 max]**  
children have high energy requirements relative to protein requirements;  
children need to eat relatively higher amounts of carbohydrate and fat than adults;  
high biological value proteins support growth;
- how preferred foods change as a person gets older [3 max]**  
taste gets more sophisticated, e.g. develops a liking for spicy foods;  
enhanced health awareness often impacts on food choice;  
adults are more prepared to eat healthy options, e.g. low fat, low salt, low sugar, high fibre; **[6 max]**

**Option E – Computer-aided Design, Manufacture and Production**

- E1.** (a) *Award [1] for identifying the strategy used and [1] for a brief explanation, [2 max];*  
assemble to order;  
they hold components and assemble the product to order; *[2 max]*
- (b) *Award [1] for identifying the strategy used and [1] for a brief explanation, [2 max];*  
fabricate to order;  
they hold raw materials and produce components to order to assemble product; *[2 max]*
- (c) *Award [1] per distinct relevant point within a brief explanation, [3 max];*  
relationship between manufacturer becomes a direct relationship,  
not mediated through a third party – the retailer;  
the manufacturer customizes the product according to the customer’s  
specific requirements; *[3 max]*
- E2.** *Award [1] for identifying a way in which virtual reality would help the company and [1]  
for a brief explanation, [2 max].*  
*e.g.:*  
simulate product;  
enable customer to visualize what they are ordering; *[2 max]*
- E3.** *Award [1] for each distinct point in explaining one advantage of JIT, [3 max] and [1]  
for each distinct point explaining one disadvantage, [3 max], [6 max total].*  
**advantages of JIT for BespokeComputerSolutions.com [3 max];**  
savings on storage space;  
reduced capital investment;  
reduced work in progress;  
fewer unsold items;
- disadvantages of JIT for BespokeComputerSolutions.com [3 max];**  
possible stoppages and loss of business;  
due to non-delivery of external components;  
or communication breakdown; *[6 max]*

**Option F – Invention, Innovation and Design**

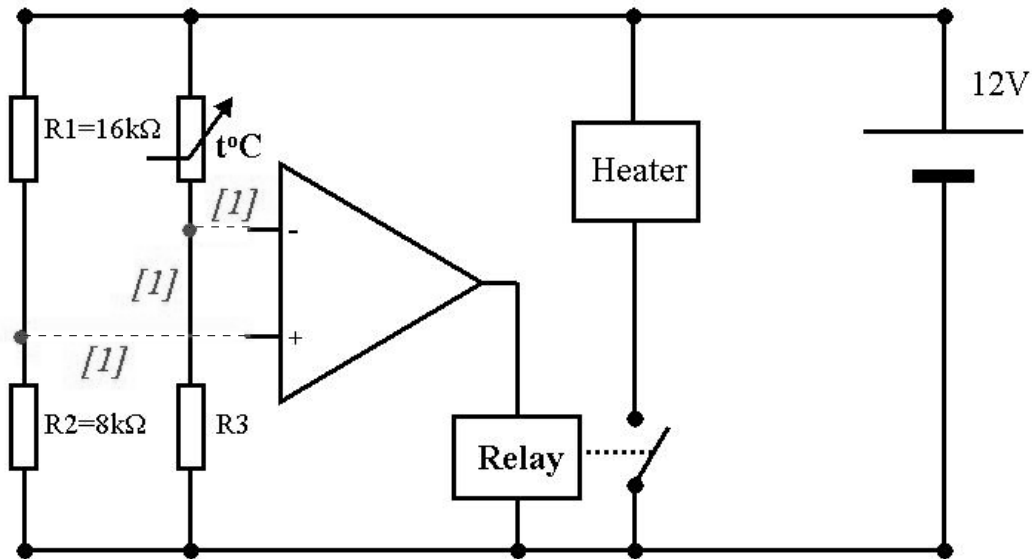
- F1.** (a) *Award [1] for a reason and [1] for a brief explanation, [2 max];*  
the refrigerator freezer is a complex product and relies on expertise from a range of disciplines;  
the expertise of one person, the lone inventor, is unlikely to be appropriate; **[2 max]**
- (b) *Award [1] for each appropriate response from the list below, [2 max]:*  
it may not be successful in the marketplace;  
it may not get appropriate financial support;  
it may not be marketed properly;  
it may not be priced right; **[2 max]**
- (c) *Award [1] for each distinct point in an appropriate explanation, [3 max]:*  
push and pull are present in most innovations;  
the concept for the design is likely to have been tested through market research;  
miniaturization of technology is likely to have enabled the design realization; **[3 max]**
- F2.** *Award [1] for identifying an appropriate benefit and [1] for a brief explanation, [2 max];*  
first in market with a new product;  
no competition / potential for largest gains / profits; **[2 max]**
- F3.** *Award [1] per distinct point up to [3 max] for each of two criteria relevant to a proactive environmental policy for the refrigerator-computer manufacturing company [6 max total].*  
**life cycle analysis of products;**  
consideration of environmental impacts of products from cradle to grave;  
ensure that environmental impact of products is reduced;
- adoption of clean technologies;**  
minimization of energy consumption;  
minimization of wastage of raw materials;  
reduction in pollution;
- emphasis on environmental issues in marketing;**  
ensure that consumers are aware of proactive stance as a marketing strategy;  
balancing of environmental factors against other factors, e.g. performance, cost and appearance; **[6 max]**

**Option G – Health by Design**

- G1.** (a) *Award [1] for a definition to the effect of:*  
Long-sightedness caused by the lens of the eye bringing rays to a focus behind the retina; *[1 max]*
- (b) *Award [1] for showing that the image is focused behind the retina, [1 max].* *[1 max]*
- (c) *Award [1] for each distinct point in a brief description [2 max].*  
use of a convex lens;  
converges light so that the image is focused on the retina; *[2 max]*
- (d) *Award [1] for each distinct correct point in an appropriate explanation, [3 max];*  
lenses can be thinner;  
thus spectacles using high refractive index glass weigh less;  
they are therefore more comfortable to wear;  
the spectacles will look better; *[3 max]*
- G2.** *Award [1] for identifying a situation in which a designer would benefit from adopting a user-centred design and [1] for a brief explanation, [2 max].*  
scenarios which the designer may not appreciate as s/he have not experienced them,  
*e.g.* in relation to dealing with disability/particular lifestyles;  
so the designer uses users as a resource to enhance his/her understanding; *[2 max]*
- G3.** *Award [1] per distinct point – [6 max] for discussing the concept of planned obsolescence and [1] per distinct point, [3 max] for the concept of reuse, each in the context of hearing aids, [6 max total];*  
**planned obsolescence [3 max];**  
hearing aid circuitry is designed to last for a specific period of time and not to be repaired but replaced;  
this means that the user can benefit from advances in technology;  
this is reflected in the design specification of hearing aids (materials, construction, durability and ease of maintenance);
- Reuse [3 max];**  
hearing aid shells are custom-made for individuals and can be reused;  
hearing aid circuits can be replaced and are not reused;  
batteries may be rechargeable so that they can be reused; *[6 max total]*

**Option H – Electronic Products**

**H1. (a)**



thermistor and R3 in appropriate arrangement;  
 connection from thermistor/R3 to -ve terminal of op-amp;  
 connection of R1/R2 to +ve terminal of op-amp;

[3 max]

(b) the thermistor will have a resistance of 10 kW at 25°C ;  
 if R3 is 5 kW then when the resistance of the thermistor drops to 10 kW the heater  
 will switch on;

[2 max]

(c) it will be possible to adjust the temperature at which the heater turns on and off;  
 by adjusting the variable resistor;

[2 max]

**H2. Award [1] for brief explanation, [2 max];**

silicon;  
 germanium;

[2 max]

**H3.** *Award [1] for each distinct point in an explanation of the significance of overdamping, [3 max] and [1] for each distinct point in an explanation of the significance of underdamping for the fish tank heater, [3 max]; [6 max total].*

**overdamping [3 max];**

occurs when excessive friction and/or a low gain amplifier is used;

the system would be sluggish;

it would take ages for the temperature to reach the desired temperature;

**underdamping [3 max];**

occurs when the load has a high moment of inertia/a high gain amplifier/low friction;

the system would respond very quickly;

however, it would overshoot the temperature and oscillations around the desired temperature would occur;

**[6 max]**

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