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M04/470/S(3)M

# MARKSCHEME

## May 2004

## DESIGN TECHNOLOGY

## Standard Level

## Paper 3

## 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.

If you have any queries on **administration** please contact immediately:

**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 an appropriate raw material **[1 max]**.*
grain waste;
paper flour; ***[1 max]***

(b) *Award **[1]** for a characteristic and **[1]** for a brief explanation, **[2 max]**.*
Cheap substrate;
ideally waste materials to make mycoprotein reasonably cheaply;
safe to eat;
no toxicological effects or contaminants from substrates;
Easily processed into acceptable food products;
to ensure that the product will have a market; ***[2 max]***

(c) *Award **[1]** for an appropriate nutritional advantage of mycoprotein **[1 max]**.*
low cholesterol/fat;
high protein;
low salt;
high fibre; ***[1 max]***

(d) *Award **[1]** for each distinct point in a description of how to convert mycoprotein into a processed produce **[2 max]**.*
Mix mycoprotein dough with binding agent and flavouring agent and colouring agent;
Put mixture into former to produce required shape; ***[2 max]***

**A2.** *Award **[1]** for each distinct point in an appropriate explanation **[3 max]**.*
corrosion resistant;
does not need finishing;
can be sterilized with heat/steam;
can be shaped into large vessels, *e.g.* the fermenter;
easy to clean;
strong;
hard wearing;
low maintenance; ***[3 max]***

**A3.** *Award **[3 max]** for why unseasoned timber needs to be seasoned and **[3 max]** for the consequences of using unseasoned timber for manufactured products **[6 max]** in total.*

**Why unseasoned timber needs to be seasoned?** ***[3 max]***

natural timber has a high moisture content;
it is not easily workable when moist;
natural timber shrinks unevenly as it dries;
needs to have stabilized dimensions within reason;

**The consequences of using unseasoned timber for manufactured products** ***[3 max]***

natural pieces of timber would distort as they dry out due to uneven shrinkage;
pieces would not be straight;
they would change in length and breadth;
joints would come apart unless well glued;
would crack easily;
more easily attacked by fungus/insects. ***[6 max]***

**Option B – Microstructures and macrostructures**

**B1.** (a) *Award **[1]** for each of two design contexts in which wire is used **[2 max]**.*
electrical/telephone wiring;
wire fencing;
wire for wire cabling;
suspension bridge;
spokes of wheels; ***[2 max]***

(b) *Award **[1]** for a characteristic and **[1]** for a brief explanation, **[2 max]**.*
ductility is reduced by alloying; [1] because the atomic structure is changed by the introduction of another metal to the base metal [1]
***[2 max]***

**B2.** (a) *Award **[1]** for each distinct point **[2 max]**.*
(Positively charged) metal atom nuclei;
in a (negatively charged) cloud/sea of electrons; ***[2 max]***

(b) *Award **[1]** for each distinct point in an appropriate explanation **[3 max]**.*
electrical conductivity requires the movement of electrons through a material;
the free electrons in the sea of electrons are extremely mobile;
the more free the electrons, the more easily heat or electricity can be conducted through the material; ***[3 max]***

**B3.** *Award **[1]** for each distinct point **[3 max]** for explaining the stress/strain graph and **[1]** for each distinct point **[3 max]** for its relevance to the manufacture of wire **[6 max]** in total.*

**The stress/strain graph *[3 max]*** ***[3 max]***
a stress/strain graph identifies the way a material responds to a load;
the stress/strain graph shows a straight line section – the elastic region;
it then shows a curved section – the plastic region;
the point at which the elastic deformation ends and plastic deformation begins is called the yield stress;

**The relevance of the stress/strain graph in the manufacture of wire *[3 max]*** ***[3 max]***
enough force has to be exerted, *i.e.* more than the yield stress, to put the material into the plastic region so the wire will then retain its size and shape when the force is removed;
if not enough force is applied the material will remain in the elastic region and will return to its original size and shape when the force is removed;
if too much force is applied, *i.e.* more than the ultimate tensile yield stress, the material will fracture; ***[6 max]***

**Option C – Appropriate technologies**

**C1.** (a) *Award **[1]** for an appropriate definition to the effect of **[1 max]**.*
Resources that are naturally replenished in a short time/less that one human lifetime; ***[1 max]***

(b) *Award **[1]** for an appropriate example of a renewable energy resource, **[1 max]**.*
wind;
wave;
water;
solar;
biomass;
hydroelectric;
tidal;
geothermal; ***[1 max]***

(c) *Award **[1]** for each distinct point in an explanation **[2 max]**.*
planned obsolescence determines the effective life of the product and makes it that it has to be replaced;
in replacing the product a later version can be purchased which is more energy efficient; ***[2 max]***

**C2.** *Award **[1]** for each distinct relevant issue **[3 max]**.*
Consumer attitudes towards energy efficiency and pollution have shifted and consumers now want less polluting more energy efficient products;
Conservation of energy resources makes products cheaper to run;
There is now a growing number of "green" consumers;
Market pull from increased awareness of green issues from consumers;
Discriminating consumers force designers to take this into account in product design. ***[3 max]***

**C3.** *Award **[1]** for each of two correct proposals agreed at the Agenda 21 conference, **[2 max]**.*
promoting sustainable energy development;
developing safe and environmentally sound transport systems;
promoting industrial development that does not adversely affect the atmosphere;
promoting industrial development that does not adversely affect the atmosphere;
promoting agricultural development that does not adversely affect the atmosphere; promoting sustainable resource development and land use;
promoting sustainable energy consumption patterns and lifestyles;
preventing stratospheric ozone deletion; ***[2 max]***

**C4.** *Award **[3 max]** for each of two ways in which energy utilization in manufacturing is consistent with sustainable development **[6 max]** in total.*

**Minimizing wastage of energy**;
minimizing wastage of raw materials;
only processing the materials required to make the product, *e.g.* in injection moulding;
lighter products comprising less raw material se less energy and are cheaper to distribute;

**Optimizing the energy efficiency of systems**;
more energy efficient systems – same performance, less energy utilization;
better insulation, *e.g.* on fridges and houses;

**Maximising the use of renewable energy sources;**
minimizes the use of non-renewable energy resources, *e.g.* fossil fuels;
conserves natural resources, *e.g.* fossil fuels for other uses and future generations;
reduces production of greenhouse gases, *e.g.* carbon dioxide, which contribute to global warming;
sulphur dioxide from power stations can cause acid rain and damage forests; ***[6 max]***

**Option D – Food technology**

**D1.** (a) *Award **[1]** for each of two organoleptic properties of food **[2 max]**.*
taste / flavour;
smell;
appearance;
texture;
sound; ***[2 max]***

(b) *Award **[1]** per distinct point in an appropriate explanation.*
the taste panel is made up of people from the same market segment as target market, *e.g.* child or adult markets;
samples are compared, often in pairs by taste panel;
the preferred sample is compared with another;
this continues until the product is considered satisfactory by the taste panel; ***[3 max]***

**D2.** *Award **[1]** mark for a reason for a way in which freezing extends the safe shelf life of ice cream and **[1]** for a brief explanation **[2 max]**.*
freezing prevents microbial growth; but it does not kill microorganisms;
freezing reduces the water activity; so water is unavailable for microbial growth; ***[2 max]***

**D3.** *Award **[1]** mark per distinct point **[2 max]**.*
increased volume but mass unchanged;
therefore density reduced; ***[2 max]***

**D4.** *Award **[1]** for each distinct correct point in an explanation up to **[2]**; **[3 max]** per way; **[6 max]** total;*
distinctive style of font and presentation, use of logo, *etc.*;
distinctive shape of package, *e.g.* coke bottle;
distinctive colour, *e.g.* Virgin, Grange;
use of particular packaging materials, *e.g.* plastic or card;

this makes the package easily recognizable;
and includes a comfort feeling in the customer;
this includes customer loyalty to the band; ***[6 max]***

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

**E1.** (a) *Award **[1]** for a definition to the effect of*
a sophisticated computerized volume production system responsive to individual customer orders. ***[1 max]***

(b) *Award **[1]** for input device.*
mouse / trackerball;
keyboard; ***[1 max]***

(c) *Award **[1]** per distinct relevant point within a brief explanation.*
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; ***[2 max]***

**E2.** *Award **[1]** per distinct point.*
the manufacturer has a "buffer" of goods in stock in case of unforeseen circumstances, *e.g.* non-delivery of supplies;
the manufacturer can respond quickly to a demand for a product;
the manufacturer can produce a steady flow of product and have a stable workforce;
less capital costs than JIT ***[3 max]***

**E3.** *Award **[1]** for each one of two appropriate computer modeling techniques **[2 max].***
*e.g.* spreadsheet;
animation;
virtual reality;
architectural software;
engineering software;
solid modeling;
surface modeling;
simulation;
rapid prototyping ***[2 max]***

**E4.** *Award **[1]** per distinct point in each of one advantage and one disadvantage. Up to **[3 max]** for advantages and **[3 max]** for disadvantages, **[6 max]** total.*

**Advantages *[3 max]*;**
some economies of scale whether the order is for 1 or a 1000 items;
ability to customize product for individual customers;
ability to implement JIT leads to savings on unsold items;
customised product can command prestige price;
direct relationship with customer rather than with third party;
greater share of profit to manufacturer than when dealing with third party;
lends itself to use of the Internet – global market place.

**Disadvantages *[3 max]*;**
expensive to set up (capital costs);
expensive to maintain;
need to invest in customer interface to handle multiple individual orders;
potential large fluctuations in demand can logjam the system;
need to work out how to deal with potential range of colour/design combinations;
increased R&D ***[6 max]***

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

**F1.** (a) *Award **[1]** for each distinct point.*
the bagless vacuum cleaner was a new product/radical design/is not based on traditional products;
it incorporates new technology/new materials in the design;
radical in aesthetics i.e. colour; transparent cylinder or style. ***[2 max]***

(b) *Award **[2 max]** for an appropriate outline (one mark for reference to an incremental feature; one mark for reference to a radical feature).*
many aspects of the design are the same or similar to what went before, *e.g.* the cyclone, the wheels, *etc*. and thus the design is partially incremental;
difference is hidden technology relating to the computerization of the robot and thus the design is partially radical; ***[2 max]***

(c) *Award **[2 max]** for an appropriate outline.*
investment in a radical design is risky;
many people like to wait to see if an idea will be successful before investing in it;
investors cannot see the potential for success (share the vision);
penetrating existing markets is difficult. ***[2 max]***

**F2.** *Award **[1]** for identifying the strategy of the Dyson company and **[1]** mark per distinct point in an explanation **[3 max]**.*
first in market with a new product;
most risky strategy;
potential for largest gains/profits;
gain brand identity;
expensive to market. ***[3 max]***

**F3.** *Award **[1]** for a distinct point for each of two reasons, **[3 max]** per reason, **[6 max]** in total.*

**Marketability/Need;**
there may not be a market for the idea;
it can be very difficult to undertake appropriate market research on a new product to establish whether there is a market;
the market may be too small;
the product may go out of fashion;

**Marketing;**
the product may not be marketed properly;
too little money may be invested in marketing;
the product may not be appropriately targeted to a market segment;

**Price;**
the product may be priced too high;
the product may not represent good value for money for customers;
the product cannot be produced for a viable selling price;

**Outlay;**
too expensive to get to production;
too long to achieve return on capital investment;

**Risk;**
risk too great for potential rewards;
lack of finance for long-term projects; ***[6 max]***

**Option G – Health by design**

**G1.** (a) *Award **[1]** per distinct point for appropriate explanation.*
at lower frequencies the person's hearing is normal and he/she would be able to hear people talking;
at higher frequencies the person would be unable to hear consonants and would find it difficult to distinguish some words from others; ***[2 max]***

(b) *Award **[1]** for an appropriate disadvantage plus **[1]** for brief explanation.*
a digital hearing aid can divide incoming sound into distinct bands which are individually selected for amplification;
thus the amplification can be tailored to an individual's hearing loss;
in this case frequencies from 2 000 – 8 000 Hertz could be amplified and sounds below 2 000 Hertz not amplified; ***[3 max]***

**G2.** *Award **[1]** for each distinct point in a description **[2 max]**;*
toxic carbon monoxide and incompletely combusted hydrocarbons are oxidized to carbon dioxide and water;
toxic nitrogen oxides are reduced to nitrogen; ***[2 max]***

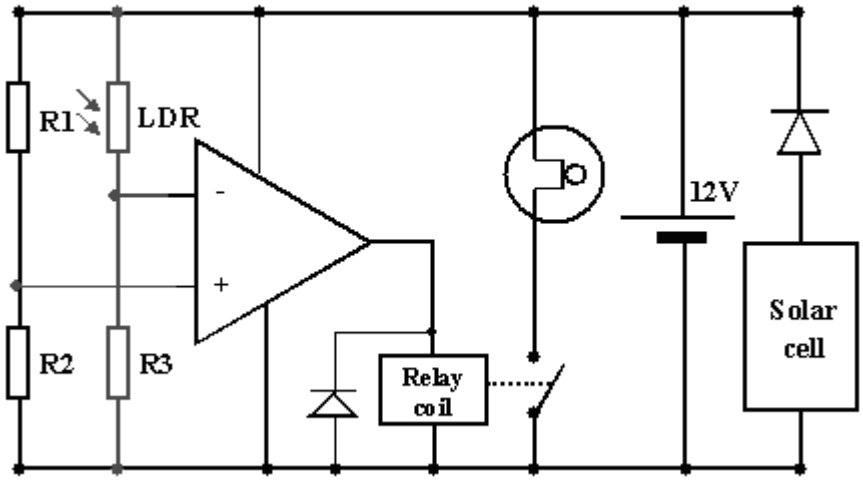
**G3.** *Award **[2]** for each distinct point in an appropriate description of an advantage of one-day disposable contact lenses **[2 max]**.*
no cleaning required;
fits in better with active lifestyles;
reduces need for cleaning chemicals;
easier for traveling; ***[2 max]***

**G4.** *Award **[1]** for each distinct relevant point, **[6 max]** total.*

| Weaving | Knitting |
|---|---|
| high dimensional stability; | low dimensional stability; |
| low water permeability; | high water permeability; |
| suitable for larger vessels; | suitable for smaller vessels; |

**Option H – Electronic products**

**H1.** (a)




LDR and R3 in appropriate arrangement;
Connection from LDR/R3 to – terminal of op-amp;
Connection of R1/R2 to + terminal of op-amp; ***[3 max]***

(b) The LDR will have a resistance of 12 kW at dusk;
If R3 is 6 kW then when the LDR resistance reaches 12V the light will switch on; ***[2 max]***

(c) Addition of a feedback resistor taking the output signal from the op-amp; and feeding it back into the inverting input; ***[2 max]***

**H2.** *Award **[2 max]** for brief explanation.*
Use of timer as one input to **OR** gate and output from op-amp as second input to **OR** gate;

If time is 2100 **OR** it is dusk then light will come on; ***[2 max]***

**H3.** *Award **[1]** for each distinct relevant point up to **[3 max]** for the difference between a digital signal and an analogue signal and up to **[3 max]** for how to convert an analogue signal into a digital signal **[6 max]** total.*

an analogue signal can change continuously to represent a physical property;
and can take on any value, *i.e.* 0 to ± infinity;
there will be a mathematical relationship between the change in the physical property and the change in the signal;
a digital signal is an encoded signal *e.g.* binary;
two discrete values – on/off, high/low;

comparator circuit (operational amplifier) circuit;
analogue input signal compared with a threshold signal;
if under threshold then digital signal 0 output;
if over threshold then digital signal 1 output; ***[6 max]***