



MARKSCHEME

May 2010

DESIGN TECHNOLOGY

Standard Level

Paper 3

21 pages

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Subject Details: Design Technology SL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer questions from **ONE** of the Options [1 x 30 marks].

Maximum total = [30 marks]

1. A markscheme often has more marking points than the total allows. This is intentional. Do **not** award more than the maximum marks allowed for part of a question.
2. Each marking point has a separate line and the end is signified by means of a semicolon (;).
3. An alternative answer or wording is indicated in the markscheme by a slash (/) – either wording can be accepted.
4. Words in brackets () in the markscheme are not necessary to gain the mark.
5. Words that are underlined are essential for the mark.
6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.
7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by writing **OWTTE** (or words to that effect).
8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. Indicate this with **ECF** (error carried forward).
10. Only consider units at the end of a calculation. Unless directed otherwise in the markscheme, unit errors should only be penalized once in the paper. Indicate this by writing **-1(U)** at the first point it occurs and **U** on the cover page.
11. Do not penalize candidates for errors in significant figures unless it is specifically referred to in the markscheme.

Option A — Food science and technology

- A1.** (a) *Award [1] for a definition of unsaturated fatty acid to the effect of:*
one in which there are double bonds present between the carbons of the fatty acid chains; [1]
- (b) *Award [1] for each of two distinct correct points in a description of the importance of unsaturated fats to health, [2 max].*
good for health; [2]
essential compounds/cannot be produced in body (cell membranes, etc.);
- (c) *Award [1] for each of three distinct points of explanation of the importance of unsaturated fatty acids in the development of rancidity and the shelf life of cooking oils, [3 max].*
double bonds are susceptible to oxidation; [3]
this leads to oxidative rancidity;
this reduces shelf life of product;
off flavours are produced in oil;
- A2.** (a) *Award [1] for a definition of lifestyle to the effect of:*
the way a person lives; [1]
- (b) *Award [1] for identifying one lifestyle factor which affects food choice and impacts on health and [1] for a brief explanation. The list below is not exhaustive and appropriate answers from candidates should be rewarded.*
living arrangements (e.g. living alone);
cooking for one person may not be conducive or as easy;

ethical issues;
vegetarians do not eat meat on ethical grounds;

sports participation;
can enforce particular dietary requirements, e.g. high energy, high protein; [2 max]

- A3.** (a) *Award [1] for each of two functions of the packaging of Coca-Cola.*
maintaining carbonation/keeping drink fizzy;
keeping the contents clean/fresh/safe;
the packaging is labelled to provide information about contents;
marketing/the package enables the promotion of other products;
security/the packaging needs to ensure that the product is not tampered with;
the packaging must be easily opened and resealed to avoid spillage; **[2 max]**
- (b) *Award [1] for identifying one way in which the packaging of Coca-Cola has contributed to the development of the Coca-Cola brand and [1] for a brief explanation, [2 max].*
the shape of the bottle same as original design/easily recognized;
even when produced in plastic rather than glass/it has become synonymous with the product/what it stands for;

the colour/lettering is consistent and is recognizable even when not on the bottle;
this makes it useful for sponsorship, *e.g.* sports sponsorship;
uses same packaging for family of products;
increases sales/market;

identifiable/recognizable;
promotes consumer confidence/facilitates product launch for new products in family; **[2 max]**
- A4.** *Award [1] for identifying one way in which food can influence cancer incidence and [1] for a brief explanation, [2 max].*
food may contain carcinogens, either naturally (*e.g.* plant alkaloids or mycotoxins) or as a result of the effect of heat on food;
carcinogenic substances can cause cancer;

balanced diet (five a day) provides body with right nutrient mix;
reduces cancer risk;

some countries have reduced rates of cancer;
linked to regional diets;

some food components (insecticides/pesticides/preservatives/colouring agents) may be carcinogenic;
carcinogenic substances may cause cancer;

some foods contain substances which protect against cancer;
e.g. garlic which contains allinase; **[2 max]**

A5. Award [1] for each of three distinct correct points in a discussion of the influence of market pull and of technology push on the development of new food products, e.g. ready meals.

market pull:

there is increasing demand for lower cost foods;
more people live alone and many people do not have cooking skills;
ready meals can be more cost-effective for single people;

there is an increasing demand for more and more convenience foods;
working women for example may have less time for cooking/families may not want to sit to eat together;
ready meals can be regenerated quickly using microwave/oven heating;

technology push:

freezers/blast chillers;
aid in production of frozen/chilled ready meals;
enhance shelf life of product;

microwaves;
make it easy to regenerate/heat food;
have promoted the development of ready meals;

packaging materials/vacuum packaging;
enhanced properties;
keep food safe/fresh in transit/storage;

[6 max]

A6. Award [1] for each of three distinct correct points of explanation of three ways in which on-farm processing can enhance farm sustainability [9 max].

on-farm processing produces products of higher value than the raw materials from which they are made;

thus a larger share of the food dollar stays in the control of the farmer;

this enhances farm sustainability;

on-farm processing creates more work in local communities;

thus more people can stay and work in rural communities;

jobs related to on-farm processing are more highly skilled and more interesting than traditional farm work;

small-scale food processing can be more appropriate than mass-production;

craft-produced foods/foods of known provenance command higher prices;

on-farm processing of foods represents a very lucrative form of farm diversification;

consumer attitudes;

farm shops/farmers' markets;

have helped change purchasing habits/support for local farmers;

reduced transport costs for farmer;

raw materials do not need to be transported for processing;

saves time/ saves money/increases profit/sustainability;

[9 max]

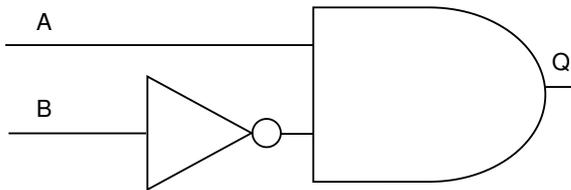
Option B – Electronic product design

- B1.** (a) Award [1] for identifying the key component of the temperature sensor.
thermistor; [1]
- (b) Award [1] for $Q=1$ when $A=1$ and $B=0$ and [1] for $Q=0$ in all other instances,
[2 max].

A	B	Q
0	0	0
0	1	0
1	0	1
1	1	0

[2 max]

- (c) Award [1] for the correct symbol for an AND gate; award [1] for the AND gate having two inputs A and B; award [1] for the correct symbol for the NOT gate on input B, [3 max].



[3 max]

- B2.** (a) Award [1] for the correct answer including units achieved by multiplying the voltage by the amperes to give the power in watts. Note subtract [1] if units are omitted.
P = V.I = 12 Watts; [1]
- (b) Award [1] for identifying the likely outcome if a 4V torch bulb were to be connected to the charged battery by mistake and [1] for a brief explanation, [2 max].
it may blow/overheat;
the power/voltage of the battery exceeds the rating of the bulb; [2]
- B3.** (a) Award [1] for stating the resistance of thermistor X at 10°C, including units
450–500 Ω; [1]
- (b) Award [1] for each of three distinct points in an explanation of how the logic circuit can be used to provide logic 0 when the temperature rises above approximately 10°C [3 max].
above 10°C the value of X falls below 470 Ω;
so the input to the logic gate rises above 2.5 V;
the output switches to logic 0; [3]
- B4.** Award [1] for identifying one reason why only a fraction of the capacity of a PIC is used in many electronics products and [1] for a brief explanation, [2 max].
generic PICs are made with many inputs/outputs and lots of memory;
it is more cost effective for a manufacturer to use the same PIC in many different products due to economies of scale; [2]
- B5.** Award [1] for each of three distinct correct points in an explanation of how a digital hearing aid can be customised to meet the requirements of an individual user initially and through the product lifecycle.
initially:
audiogram analyses frequency response of an ear;
hearing aid divides (filters) incoming sound into frequency bands;
amplifies where appropriate;
recombines the bands to compensate for hearing deficiencies;

through the product lifecycle:
hearing may deteriorate over time;
a new audiogram can provide the information necessary to re-programme the PIC;
this extends product life; [6 max]

B6. Award [1] for each of three distinct correct points in an explanation of each of three reasons why copper wires are being replaced by fibre optic cables in modern digital communication systems based on frequency division multiplexing, [9 max].

frequency division multiplexing requires a certain bit rate and therefore bandwidth;
recent applications require a lot more information and therefore bandwidth;
copper cables have much lower bandwidth and hence capacity than fibre optic cables which have a huge bandwidth;

fibre optic cables are based on light;
less vulnerable to electromagnetic interference;
more secure;
many users share links simultaneously;

fibre optic cables are more cost-effective;
copper is expensive, sand is not (fibre optic cable core is made of glass);
less power is needed to run a fibre optic link;
repeaters can be spaced further apart;
copper wires require more maintenance;

[9 max]

Option C – CAD / CAM

- C1.** (a) *Award [1] for stating one benefit for the consumer of using knock-down (KD) fittings in the design of the bed shown in Figure C1.*
they are easy to use;
they are very suitable for use for flat-pack furniture;
they can be put together easily;
they use simple tools;
they can be disassembled and reassembled in another location;
they can be disassembled for repair/recycling;
they are suitable for use by unskilled persons; **[1 max]**
- (b) *Award [1] for each of two distinct correct points in a description of how the exploded drawing in Figure C1 will help consumers in the assembly process for the wardrobe, [2 max].*
the consumer can check that s/he has all the correct parts/the consumer can see how the parts fit together;
this should make it easier for the consumer to assemble the wardrobe/the consumer can see what the finished article should look like; **[2]**
- (c) *Award [1] for each of three distinct points of discussion of one advantage of using CAM in the manufacture of flat-pack, [3 max].*
quality control;
CAM is a very precise manufacturing process;
can produce parts with low tolerances;
this ensures that the parts fit together accurately;

cost;
CAM is a very cost-effective system;
CAM can minimize price for consumer/increase profit for manufacturer;

mass customization is possible;
subtle changes to the design can be made easily;
the revised design can then be produced cheaply and quickly using CAM; **[3 max]**
- C2.** (a) *Award [1] for stating the term given to the manufacturing of 3-D parts by depositing molten material in a series of layers.*
solid object printing; **[1]**
- (b) *Award [1] for identifying a product/context where a laser cutter could be used to manufacture parts and [1] for a brief explanation, [2 max].*
production of 2-D shapes;
cutting a shape from a sheet of material/engraving a pattern onto the surface of a material; **[2]**

- C3.** (a) *Award [1] for identifying one way in which the use of CAD has simplified the manufacture of jewellery and [1] for a brief explanation, [2 max].*
settings;
a range of settings for the stone can be selected;
- communication between the designer and the consumer;
enables collaborative design of product;
- patterns;
it is easy to alter the engraved design of the patterns of the ring using CAD;
- sizes;
it is very easy to alter the size of the ring using CAD;
- virtual products;
reduction in costs as the ring does not have to be produced until a consumer actually wants to make a purchase; **[2 max]**
- (b) *Award [1] for identifying one way in which a scanner can be used to aid jewelry design using CAD and [1] for a brief explanation, [2 max].*
scan in the image;
manipulate in CAD to produce a new design; **[2]**
- C4.** *Award [1] for each of two issues for manufacturers when choosing CNC equipment [2 max].*
costs;
flexibility;
maintenance;
tooling;
training;
speed;
quality of finish; **[2 max]**
- C5.** *Award [1] for each of three distinct correct points in a discussion of two limitations of using 3-axis machining to make the product in Figure C5, [6 max].*
time;
repositioning of the work piece at different angles is time consuming;
also can result in errors in manufacture;
- additional tooling and fixtures are needed to hold the work piece in place;
this can increase the cost and complexity of the manufacturing process;
some parts may challenge production using 3-axis machining; **[6]**

C6. Award [1] for each of three distinct correct points of discussion of three advantages to the manufacturer of operating a computer integrated manufacturing (CIM) system [3 max] per advantage, [9 max].

staff morale;

better working environment;

staff morale should be enhanced;

reduction of waste;

optimization of material wastage;

this can lead to more efficient use of raw materials;

cost-effectiveness of manufacture;

high set-up costs;

more cost-effective for high volume of production;

quality;

may be more consistent due to higher precision;

actual quality may be lower than with CIM;

[9 max]

Option D – Textiles

- D1.** (a) Award [1] for a definition of biomimetic to the effect of:
the application of methods and systems found in nature to the study and design of engineering systems and modern technology; [1]
- (b) Award [1] for identifying a reason why the bodysuit has to fit like a second skin and [1] for a brief explanation [2 max].
to reduce drag; [2]
the tight fit streamlines the body shape;
- (c) Award [1] for each of three distinct correct points in an explanation of why a composite material is used for the manufacture of the bodysuit, [3 max].
the desired properties of the fabric can be designed in; [3]
the proportion of Lycra® can be adjusted to determine the stretchability of the fabric;
the proportion of polyamide can be adjusted to determine the dimensional stability of the fabric;
- D2.** (a) Award [1] for a definition of brand to the effect of:
a product/service/concept from a known source which can be marketed to promote customer loyalty/an image of a company which distinguishes it from competitors; [1]
- (b) Award [1] for identifying a strategy which would contribute to the development of a brand and [1] for a brief explanation [2 max].
sponsorship, e.g. of sports events such as Olympics;
high profile events offer great exposure for sponsors to promote brand awareness;

support for good causes, e.g. children’s charities;
appeal to specific market segments, e.g. philanthropically or environmentally-aware consumers;

unique design/product;
customer can recognise the company just by looking at the product;

consistency of use of colour/logos/straplines;
reinforce brand image; [2 max]

- D3.** (a) Award [1] for each of two distinct correct points in a description of the market for products developed using the embroidery system, [2 max].
suitable for people wanting one-off products and small volume production;
e.g. sports clubs (or other similar example); [2]
- (b) Award [1] for identifying one way in which the embroidery system can help to enhance designer-client relationships and [1] for a brief explanation, [2 max].
interaction with/involvement of client in design process;
enables changes to be made at an appropriate time rather than one product is manufactured and resources/time wasted; [2]
- D4.** Award [1] for identifying one negative impact of product branding of textile garments on the health of adolescents and [1] for a brief explanation, [2 max].
branded products are promoted by models and other celebrities who are often extremely underweight;
adolescents are strongly influenced by such promotions and may seek to achieve similar physique to the detriment of their health; [2]
- D5.** Award [1] for each of three distinct correct points in a discussion of two advantages of using SMART textiles in cars [3 max] per advantage, [6 max].
comfort sensors in textiles used for seats;
detect comfort levels of driver/passenger;
adjust temperature, etc. accordingly;
- “triple fresh” and similar treatments on carpets;
decompose pollutants – cigarette/animal smells;
keep car smelling fresh;
- detectors to check if driver asleep or awake;
if driver asleep apply brakes;
this will ensure road safety; [6 max]

D6. Award [1] for each of three distinct correct points in an explanation of each of three ways in which finishing processes are used to modify the performance characteristics of textile products [3 max] per way, [9 max].

fire retardancy;

textiles, e.g. curtains and children's night attire, may be coated with flame retardant substance;

this may reduce their flammability and contribute to safety issues;

waterproofing;

e.g. of rainwear/tents/etc.;

prevent them being wetted;

durability;

protective finish can extend product life;

reduction of microbiological damage/increased resistance to chemicals;

enhance/modify textile properties;

increase performance in use;

e.g. absorbency/elasticity;

soil release;

coating textiles may ensure that soil cannot penetrate fibres of textile;

useful for carpets to prevent soiling from shoes, animals, etc.;

ease of maintenance;

fabrics can be treated to make them easy to iron;

this will reduce time/effort in laundry;

[9 max]

Option E – Human factors design

- E1.** (a) *Award [1] for one advantage:*
cheap/low cost;
easy to do;
accessible;
quick;
easily modified;
design can be developed quickly;
makes communication easier between team members; *[1 max]*
- (b) *Award [2] for:*
it involves users;
in development of a design; *[2]*
- (c) *Award [1] for each point in an explanation.*
the user represents the target market;
under guidance from the facilitator;
the user provides feedback on the user–product interface; *[3]*
- E2.** (a) *Award [1] for:*
interval; *[1]*
- (b) *Award [2] for:*
the numbers represent only a convenient order;
they do not relate to absolute values; *[2]*
- E3.** (a) *Award [2] for a description along the lines of:*
they show the interaction of the user with objects in the kitchen;
and frequency of use for a specific task; *[2]*
- (b) *Award [2] for a suitable outline.*
an efficient arrangement of products and fixtures;
reduces travel and lessens the chances of an accident *e.g.* when carrying heavy
pans/pans with hot liquids; *[2]*

E4. Award [1] for stating a reason and [1] for a point in a description.
2-D drawings may not accurately represent 3-D appearance;
designer can see proportion of whole product in 3-D;

provides a 3-D example of a product;
prototype looks and feels like the final “new” product;

simulate selected features;
prototype may simulate weight, balance or material properties;

marketing;
prototype can give marketers prompts for a marketing campaign;

[2 max]

E5. Award [1] per distinct point in a suitable discussion of each issue [3 max] × 2

layout (a) is the most logical design based on human factors;
as it is easy to identify which controls operate which hob;
layout (c) is more space efficient but may not be obvious which controls operate
which hob;

layout (b) is a compromise between (a) and (c);
but the shape is odd;
and would not be suitable for a standardised fitted kitchen;

although (c) is better for aesthetics;
and fitting in with other appliances;
it is not as easy to identify which control knobs operate which hob;

(c) is less safe than the other arrangements;
when all four hobs are in use;
because the user has to lean over the pans on the front hobs to reach pans on the
rear hobs;

[6 max]

E6. Award [1] per distinct point in a suitable discussion [3 max] × 3

space is often allocated based on standardized tasks;
but different individuals have different personal space needs;
and may be uncomfortable/compromised by the pre-determined layout;

lack of flexibility;
a standardized layout does not offer individuals the opportunity to customize their
personal space;
to match their needs;

research used to decide on the standardized layout;
may be generic in nature;
and not appropriate for the needs of all types of office;

standardization may make the office environment safer;
as cables *etc.* can be hidden;
reducing trip hazard risks;

use of standard fixtures;
may provide an unappealing environment;
which constrains user satisfaction reducing efficiency;

standardized products and components;
do not take into account variations in human sizes;
as one size does not fit all;

psychological factors such as temperature and light;
may be standardized throughout the office;
but individual's needs vary;

perception;
a standardized layout may meet the functional requirements of the office;
but users may have a different perception of the suitability of the layout;

[9 max]