

MARKSCHEME

November 2005

DESIGN TECHNOLOGY

Higher Level

Paper 3

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Subject Details: Design Technology HL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in each of **TWO** Options (total *[20 marks]*). Maximum total = *[40 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 penalised. 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 penalised 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 penalise candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

Option D — Food technology

- D1.** (a) *Award [1] for an appropriate lifestyle factor and [1] for a brief explanation, [2 max].*

increased leisure time;
many people like to cook as a leisure pursuit and produce home made products; **[2 max]**

- (b) *Award [1] per distinct point in an appropriate description of what causes browning of bananas during food preparation, [2 max].*

when cells are damaged during food preparation;
enzymes (polyphenol oxidase) come in contact with (phenolic) substances (e.g. the amino acid tyrosine) which are oxidized to produce polymerized brown pigments; **[2 max]**

- (c) *Award [1] per distinct appropriate item from the following list [2 max].*

fat content;
sugar content;
nutritional content;
ingredients;
warnings;
volume, mass details;
sell by date;
storage instructions;
serving suggestions; **[2 max]**

- D2.** *Award [1] for each distinct point.*

the volume of the ice cream increases as the mixture expands on churning due to the incorporation of air into the mixture;
thus the density of the ice cream is reduced; **[2 max]**

- D3.** *Award [1] for an appropriate consideration and [1] for saying what the problem is and [1] for saying how it would influence the recipe [3 max].*

cream has a high fat content;
high fat intake can result in heart disease;
use less cream/ try yoghurt as an alternative to reduce fat content;

high sugar content;
high sugar intake can lead to heart disease and diabetes;
use artificial sweeteners or fresh fruit instead of sugar to sweeten the ice cream; **[3 max]**

D4. *Award [1] for each distinct point [3 max] per strategy; [9 max] total.*

Ensure raw materials are not contaminated on arrival at the premises;

use good quality raw materials;

buy raw materials from reputable suppliers;

ensure that raw materials have been transported appropriately chilled;

check the temperature of raw materials on arrival;

Maintain high standards of hygiene;

ensure that food handlers are aware of the importance of good personal hygiene and have received appropriate food hygiene training;

hand washing removes potential food poisoning bacteria from hands;

food handlers should wash hands after going to the toilet, touching hair, nose, skin,

handling the waste bin or other potentially contaminated material;

Good design and layout of food preparation areas;

well-designed areas are easy to keep clean;

the layout should ensure that raw and cooked foods are kept separate;

Ensure that food poisoning bacteria cannot grow in foods;

ensure that ingredients are kept chilled before use;

keep ingredients below 8 or above 63 °C during preparation;

[9 max]

Option E — Computer aided design, manufacturing and production

E1. (a) *Award [1] per correct input device and [1] per correct output device from the following lists, [2 max].*

Input device;

mouse;
keyboard;
scanner;

Output device;

printer;
CNC machine;
CAM;

[2 max]

(b) *Award [1] per distinct correct benefit of computer modelling from the following list, [2 max].*

realistic image;
different views can be seen;
quicker;
can be interfaced with CAM;
can be interfaced with CNC;
texture can be added/changed;
colour can be added/changed;

[2 max]

(c) *Award [1] for identifying an appropriate advantage of CAD to designers and [1] for a brief explanation, [2 max].*

rapid modification of designs;
enables designer to change key features or scale;

convenient storage of computer images;
they can easily be retrieved;

realistic images produced;
designers are able to present information quickly and accurately;

[2 max]

E2. *Award [1] for each distinct point in a description of how CAD is interfaced with other pieces of equipment to provide a CAD/CAM system [2 max].*

a CNC machine/sewing machine/knitting machine/lathe /milling machine/shaper can be interfaced to a CAD system on a PC to produce a CAD/CAM system;

Graphics on a CAD system are translated to a set of programming coordinates which instruct the machine to manufacture the design seen on the screen;

[2 max]

E3. *Award [1] per distinct appropriate point in an explanation of how mass customization of the model car could benefit the consumer [3 max]*

mass customization combines the benefits of one-off customization with the benefits of mass production;
mass production offers economies of scale which keeps the price down for consumers;
customization allows the customer to specify the particular features they require;

[3]

E4. *Award [1] for each distinct reason for why a company would consider Design for Manufacture and [1] for each additional point of explanation, [3 max] per reason, [9 max] total.*

design for materials/process involves consideration of the selection of materials in relation to how they can be processed;
this may mean designing it so materials can be processed using injection moulding or other particular production method, e.g. injection moulding;
capital costs of equipment are high and using existing equipment will ensure cost savings;

design for assembly takes account of assembly at various levels – component to component, components into sub-assemblies, subassemblies into products;
e.g. minimizing the number of parts/using standard components/designing parts for ease of fabrication/using snap fittings instead of welding and gluing makes them easier to disassemble;

design for assembly may result in reducing the complexity of the design;
this may minimize handling;
it will in turn reduce processing costs;

design for disassembly involves considering the way that products can be disassembled;
making the parts all from one material means that they do not have to be disassembled for the materials to be recycled;
this is likely to promote recycling;

[9 max]

Option F — Invention, innovation and design

F1. (a) *Award [1] for either:*

bicycle frame;
wheel;

[1 max]

(b) *Award [1] for each distinct point in an explanation of how producing the Lotus bicycle can be considered a pioneering corporate strategy for Lotus Engineering, [3 max].*

Lotus introduced a totally new product;
the new product was in an areas which the company had no experience of;
this was risky;
but potentially financially lucrative;

[3 max]

F2. (a) *Award [1] for identifying a reason why many governments provide cycling as part of a pro-active environmental policy and [1] for a brief explanation, [2 max].*

cycling is a good mode of transport in relation to the environment;
as it is non-polluting;

cycling uses only human energy;
and so does not contribute to the depletion of energy resources;

cycling does not need the same space as motor transport;
so causes less visual pollution;

cycling is relatively quiet;
so does not cause noise pollution;

[2 max]

(b) *Award [1] for each distinct point in an explanation of why the design of the bicycle does not satisfy the criteria for a pro-active environmental policy [3 max].*

the frame is made from carbon fibre which is a composite material;
composite materials are not recyclable;
because they are difficult to separate;

[3 max]

F3. *Award [1] for identifying a characteristic of a lone inventor and [1] for a brief explanation, [2 max].*

they are used to working alone;
and so may not work well in a team;

they may be quite dogmatic;
and hence not have a flexible working attitude;

they are determined;
and so persevere against all odds;

[2 max]

- F4.** Award **[1]** for each distinct point of discussion of each of three reasons for the continuing success of the bicycle as a global invention, **[3 max]** per reason, **[9 max]**. **[2 max]**

in developing countries many people still rely on the bicycle as an essential or only means of transport;

bicycles are adaptable e.g. trailers can be fitted;
and are cheap to use;

bicycles are easy to maintain;
by the majority of users;
parts are relatively cheap;

a range of bicycles are available;
for different market segments;
and at different prices;

the push for “greener” products promotes the increased use of bicycles;
many consumers use bicycles to reduce their car use;
to play their part in sustainable development;

bicycles have little planned obsolescence compared to other products;
and so the product life cycle is longer;
and consumers get good value-for-money;

increased awareness of the need for a healthy lifestyle;
cycling is promoted as part of this lifestyle;
leading to increased sales;

as part of the increased participation in outdoor activities;
bicycles are used for more leisure and holiday purposes;
which has increased sales;

the mountain bike has changed the image of cycling;
so bicycles are in fashion;
in a similar way to 4 × 4 vehicles;

bicycles are easy to manufacture;
for volume production;
which makes them relatively cheap/affordable;

[9 max]

Option G — Health by design

G1. (a) *Award [1] for a definition to the effect of:*
an artificial limb, tooth or other part of the body manufactured to take the place of a missing or dysfunctional one; **[1 max]**

(b) *Award [1] for each distinct correct point in an explanation of why user-centred design is an important element in the design of prostheses [3 max].*

designers are unlikely to understand fully the issues associated with prosthesis use unless they themselves are amputees;
working with users can enhance their understanding of prosthetic design issues;
designers do not then have to rely on their tacit understanding; **[3 max]**

G2. *Award [1] for naming an appropriate technology and [1] for a brief description [2 max].*

internet technology;
choose prosthetic design to suit individual needs;

mechanisms;
adjustments to individual characteristics;

materials;
react appropriately for individuals; **[2 max]**

G3. *Award [1] for a statement about allografts and [1] for a statement about autografts to the effect below [2 max].*

allograft is tissue taken from the body of another person;
autograft is tissue taken from the same body as the one it is to be transplanted to; **[2 max]**

G4. *Award [1] for each of three distinct correct points in an explanation of how the location in which a hearing aid is worn can suit an individual's lifestyle [3 max].*

in the ear or in the canal hearing aids fit onto the ear and are good for spectacle wearers;
however they are not good for people using a telephone due to feedback;
they are less obvious and thus better for people who are more conscious of their appearance;
behind the ear aids fit behind the ear;
they are good for use in noisy situations as they can have dual microphones;
they are good for people who have difficulty handling small objects;
they are not good for spectacle wearers;

[3 max]

G5. *Award [1] for each distinct correct point in an explanation [3 max] of each of three aspects of the design of a computer work station to minimize repetitive stress injury (RSI) [9 max].*

keyboard;
ergonomic design;
suitable height;

chair;
height and back adjustments;
correct posture;

screen;
non-glare;
correct height;

desk;
adjustable keyboard section;
ease of reach;

[9 max]

Option H — Electronic products

H1. (a) *Award [1] for:*
component R1 = Light dependant resistor; **[1 max]**

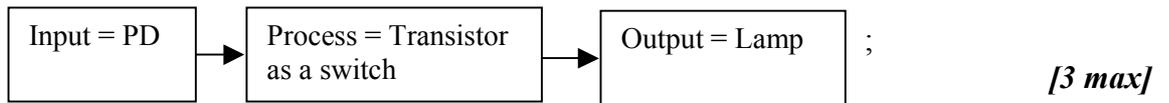
(b) *Award [1] for identifying the function and [1] for a brief description.*

Components R1 and VR1 work jointly as a Potential Divider;
the joint function of these two components can be set to trigger the transistor, TR1,
so as the light level drops the transistor acts as a switch; **[2 max]**

H2. (a) *Award [1] for each distinct, correct point in an explanation of how a systems approach could be applied to circuit design [3 max].*

electronic systems can be described in terms of block diagrams;
the simplest comprises three elements Input, Process and Output;

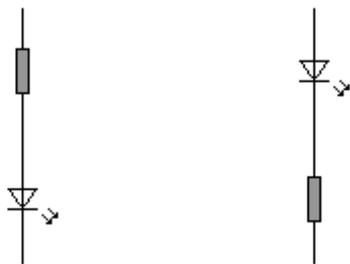
in this circuit, the Input is Potential Divider, the Process is the Transistor as a switch
and the output is the lamp. *Accept this drawn as a diagram (see below).*



(b) (current limiting) resistor needs to be inserted in series with the LED;

OR

Accept either of the diagrams below;



[1 max]

(c) the component shown as TR1 is a transistor and it is used as a switch; **[1]**

H3. *Award [1] for each of two distinct points.*

testing can take place in simulation software;
thus the circuit can be tested virtually and does not have to be physically built; **[2 max]**

H4. *Award [1] for a definition to the effect of:*

a programmable system is a microprocessor/microcontroller whose functions can be altered using some form of computer software to make the changes; **[1]**

H5. *Award [1] for each distinct correct point in a discussion of how smart cards could be used so that only the young person whose bedroom it is has control of the wall light [9 max].*

There are two types of smart cards:
contact smart cards;
and contactless smart cards;

in the case of the lamp, it matters not which type is used but a contact smart card provides a more simple solution;
a simple smart card reader would be inserted to replace the power on/off switch;
a smart card contains electronic memory on which the details of the user are stored;
in this case it could hold details and produce a unique identity as to the owner of the lamp/room;
the card reader makes contact with the electronic connectors on the card, makes a check of the data against a look-up table in the PIC and if the data is correct switches on the lamp;
cards could be “formatted” so that a number of different users could have different functions;
the same card could be used to open the bedroom door of the young person; **[9 max]**
