



# **MARKSCHEME**

**May 2011**

## **DESIGN TECHNOLOGY**

**Higher Level**

**Paper 3**

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## General Marking Instructions

*Assistant Examiners (AEs) will be contacted by their team leader (TL) by e-mail (or telephone) – if by e-mail, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this initial contact is to allow AEs to raise any queries they have regarding the markscheme and its interpretation. AEs should contact their team leader by e-mail at any time if they have any problems/queries during the marking process.*

### Note:

The DHL courier service must be used to send assessment material to your team leader/senior moderator and to IB Cardiff. (However, this service is not available in every country.) The cost is met directly by the IB. It is vitally important that the correct DHL account number is used.

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

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1. Follow the markscheme provided, award only whole marks and mark only in **RED**.
2. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**
3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking. It should be remembered that the script may be returned to the candidate.
4. Unexplained symbols or personal codes/notations are unacceptable.
5. Record marks in the right-hand margin against each mark allocation shown in square brackets *e.g.* [2]. The total mark for a question must equal the number of ticks for the question.
6. Do **not** circle sub-totals. **Circle the total mark** for the question in the right-hand margin **at the end of the question.**
7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin next to the square bracket.
8. Where work is submitted on additional sheets the marks awarded should be shown as ticks and a note made on both the additional sheet and in the right-hand margin of the corresponding question part in the body of the script.
9. For each Option: Add the totals for each question in the Option and write it in the Examiner column on the cover sheet.  
Total: Add the marks awarded and enter this in the box marked TOTAL in the Examiner column on the cover sheet.
10. After entering the marks on the cover sheet check your addition to ensure that you have not made an error. Check also that you have transferred the marks correctly to the cover sheet. **All scripts are checked and a note of all clerical errors will be given in feedback to examiners.**
11. If an answer extends over more than one page and no marks have been awarded on a section draw a diagonal line through that section to indicate that it has been marked.
12. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers and use the marks of those answers that have the highest mark, **even if the candidate has indicated the question(s) to be marked on the cover sheet.**
13. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. A mark should not be awarded where there is contradiction within an answer. Make a comment to this effect in the left hand margin.

## Subject Details: Design Technology HL Paper 3 Markscheme

### Mark Allocation

Candidates are required to answer questions from **ONE** of the Options [**1 × 40 marks**].

Maximum total = [**40 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 stating the percentage of the GDA for energy for an average adult woman provided by cheeseburger, large fries and medium chocolate milkshake meal.*  
 $15 + 23 + 21 = 59 \%$ ;  
 $1170/2000 = 58.5 \%$ ; **[1 max]**
- (b) *Award [1] for each point in an outline of one reason why a balanced diet should contain fat [2 max].*  
 fat acts as a vehicle to help the absorption of fat-soluble vitamins;  
 these prevent fat-soluble vitamin deficiencies;
- fat provides energy;  
 low fat diets may not provide enough energy;
- some fatty acids are essential;  
 they cannot be produced by the body and must be provided by the diet for health; **[2 max]**
- (c) *Award [1] for each of three distinct correct points in an explanation of one implication of excess fat intake for health [3 max].*  
 high dietary fat intakes, especially of saturated fat, can lead to increased levels of cholesterol;  
 this can lead to coronary heart disease/obesity;  
 resulting in poor health; **[3]**
- A2.** (a) *Award [1] for a definition of food hygiene to the effect of:*  
 all aspects of the processing, preparation, storage, cooking and serving of food to make sure that it is safe to eat/does not make people ill; **[1]**
- (b) *Award [1] for each point in an outline of one consideration relating to the control of food hygiene for food which is available for purchase in the street [2 max].*  
 dust and other debris/people accidentally or deliberately coughing/spitting into the food/birds defecating;  
 contamination of the food which is not properly heated would cause food poisoning;
- weather;  
 hot temperatures/climates will impact on food storage time;
- pollution;  
 from car exhausts/factories;
- use of utensils/tongs;  
 to pick up food rather than use hands;
- keeping the food covered;  
 to prevent contamination; **[2 max]**

- A3.** (a) Award [1] for stating the type of spoilage and [1] for a brief explanation [2 max].  
microbiological spoilage;  
mould/fungus is growing on the tomato; [2]
- (b) Award [1] for each point in an outline of how sun drying of tomatoes can be used to preserve them [2 max].  
lowers water activity/reduces water content;  
this prevents bacterial growth; [2]
- A4.** Award [1] for each of three distinct correct points in an explanation of each of two distinct lifestyle issues which have contributed to the growing market for organic products in some countries [3 max] per issue [6 max].  
increased health awareness and concerns about food scares, e.g. mad cow disease, salmonella in eggs;  
people are more interested/concerned about where food comes from;  
organic products often have a known provenance;  
  
fashion and media influences;  
it is “cool” to be organic;  
makes a statement (ideopleasure);  
  
ethical considerations;  
concerns about factory farming and animal rights issues;  
organic produce seen to be more appropriate;  
  
supermarkets have promoted organic produce;  
this gives it a higher consumer profile;  
although more expensive, people are prepared to pay a premium for organic products as they are perceived to be better;  
  
increase in leisure time;  
more people have the opportunity to grow produce;  
and guidance is readily available;  
  
taste/flavour;  
many consumers think that organic produce tastes better;  
because they grow under natural conditions;  
  
marketing of “grow your own” kits by DIY stores etc;  
encourages consumers to produce their own food;  
by providing seeds/plants in containers with nutrients/instructions; [6 max]

- A5.** (a) *Award [1] for each of two distinct correct points in a description of undernourishment [2 max].*  
chronic food insecurity;  
food insufficient to meet basic energy requirements/provision of essential nutrients on continuing basis;  
nutrient intake can be restricted by age-related illnesses and conditions, excessive dieting, food allergies, severe injury, serious illness, a lengthy hospitalization, or substance abuse;  
excreting nutrients more rapidly than they can be replaced, *e.g.* due to diarrhoea,; excessive sweating, heavy bleeding or kidney failure;  
problem for infants, young children, teenagers and women who are pregnant or breastfeeding; **[2 max]**
- (b) *Award [1] for listing each of two implications of climate change that may lead to increased undernourishment in the developing world [2 max].*  
floods;  
drought;  
temperature change;  
erratic weather patterns;  
gales/high winds; **[2 max]**
- (c) *Award [1] for each point in an outline of one strategy to deal with the implications of climate change to increased undernourishment [2 max].*  
irrigation/flood prevention schemes;  
ensure optimum water reaches food crops;  
  
desalination schemes;  
remove salt from sea water and make it fit for agricultural use;  
  
develop different cultivars that are able to cope with the different conditions;  
*e.g.* drought resistant/salt resistant; **[2 max]**
- A6.** (a) *Award [1] for each of three distinct correct points in an explanation of the principles underpinning genetic modification of crops such as Golden Rice [3 max].*  
genetic material/DNA from one species is isolated, often from a gene library;  
it is inserted into the genome of another species using a vehicle, *e.g.* a plasmid, a virus or a gene gun for the transfer;  
selection of the GMO that has been appropriately modified from those that have not; **[3 max]**



- (b) Award [1] for each of three distinct correct points in an explanation of one ethical issue underpinning public concerns about the safety of genetically modified foods, e.g. Golden Rice [3 max].

perceived safety issues;  
there are concerns that not enough is known about the potential risks of GM crops;  
health risks e.g. allergies, etc.;

ecological concerns;  
accidental cross-pollination with traditional crops;  
contamination of natural gene pool;

economic concerns;  
GM crops are subject to intellectual property law;  
this makes them more expensive and may put them out of reach of the people who need them;

farmers traditionally save their seed to sow the following year;  
if this was done with GM seed then seed developers would not profit from their work;  
thus GM seed is subject to licensing making it expensive;

there are concerns that we should not be modifying genes at all;  
it's playing God/unnatural;  
it's wrong to mix genes from different organisms;

agriculture is already too technological;  
genetic engineering will only make it worse;  
there are better ways to improve resistance and reduce chemicals on the land;

labelling measures are inadequate;  
people do not know whether they are getting GM foods or not;  
they therefore cannot freely make a choice;  
particularly important for religious and vegetarian groups who would object to genes from some species;

[3 max]

**A7.** Award [1] for each of three distinct points in an explanation of each of three reasons for the increased incidence of food allergies and food intolerance in developed countries [3 max] for each factor [9 max].

better diagnosis of food intolerance;  
provides better data on food intolerance;  
although still may be underestimating extent of food intolerance;

people eat a wider range of foods than they may have done previously;  
travel, the media, availability of different foods has increased;  
foods introduced later in life may cause more problems than those introduced early in life;

increased use of food additives/more exposure to environmental chemicals;  
trigger allergic reactions;  
results in increased food allergies/intolerance;

increased sanitation;  
results in removal of helpful bacteria from environment and gut;  
probiotic bacteria, e.g. from probiotic yogurt, may improve food/lactose tolerance;

genetics;  
allergies handed down from generation to generation;  
creates an on-going problem;

increase in manufacture of processed foods;  
with traces/ingredients of trigger foods;  
e.g. nuts/dairy;

[9 max]

**Option B – Electronic Product design**

**B1.** (a) Award [1] for stating the logic gate required for the security system.  
OR gate;

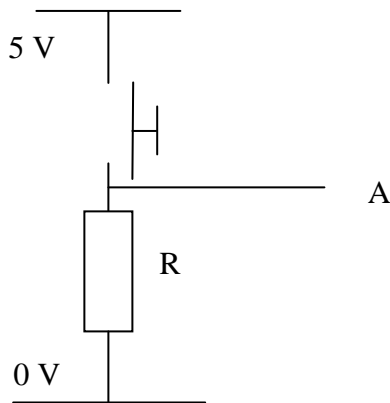
[1]

(b) Award [1] for including all eight input combinations (in any order) and [1] for only having a 0 when all inputs are 0 [2 max].

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

[2 max]

(c) Award [1] for using the correct symbol for a push switch, [1] for labelling of 0V, 5V and output A and [1] for use of a pull down resistor (any value) [3 max].



[3 max]

- B2.** (a) Award **[1]** for a definition of dematerialization to the effect of:  
the reduction in the weight and use of materials; **[1]**
- (b) Award **[1]** for each of two ways in which manufacturers can minimize the damage caused to the environment during the life of an electronic product **[2 max]**.  
minimize use of toxic materials;  
design products which last longer;  
design for disassembly;  
design so product can be upgraded;  
design using recycled material;  
design using reuseable parts;  
design for recycling;  
design for minimal energy usage; **[2 max]**
- B3.** (a) Award **[1]** for each point in an outline of one difference between a digital and an analogue signal **[2 max]**.  
an analogue signal is continuously varying and can take any value;  
a digital signal takes discrete steps/can be represented as binary number/is on or off/0 or 1; **[2]**
- (b) Award **[1]** for each point in an outline of one reason why a Schmitt trigger NOT gate is more suitable than a standard NOT gate when converting an analogue signal to a digital signal **[2 max]**.  
a Schmitt trigger has a dead band;  
it does not respond to small changes that might happen with an analogue signal; **[2]**
- B4.** Award **[1]** for each distinct correct point in a discussion of one advantage and one disadvantage for an Internet service provider operating a satellite-based rather than an optical fibre-based system **[3 max]** for an advantage and **[3 max]** for a disadvantage, **[6 max]** in total.  
Advantage **[3 max]**:  
satellite footprint gives coverage in remote areas;  
do not have to be laid over terrain physically;  
footprint can be moved easily according to need;
- Disadvantage **[3 max]**:  
cost/satellite systems are expensive;  
the antenna must be accurately pointed at the satellite;  
they can be disrupted by bad weather; **[6 max]**

- B5.** (a) *Award [1] for each point in an outline of one way in which convergent technologies could enhance human communication [2 max].*  
removal of barriers to communication;  
e.g. physical disabilities, language differences, geographic distance; [2]
- (b) *Award [1] for each point in an outline of one way in which convergent technologies could be applied to national defence [2 max].*  
technologies designed to keep humans remote from the combat zone;  
secure communication of real-time information to front line combatants;  
  
information gathering and processing technologies;  
interfacing combatants with weapon systems; [2 max]
- (c) *Award [1] for each point in an outline of one way in which converging technologies could improve human health [2 max].*  
application of nanotechnologies to implants;  
for diagnostic purposes/treatment purposes;  
  
brain/machine interface;  
regenerative biosystems for repair/replacement of organs; [2 max]
- B6.** (a) *Award [1] for each distinct correct point in an explanation of one way in which modern electronic computer systems are used to monitor and perform functions in a smart home [3 max].*  
integration of a range of functions;  
e.g. heating; lighting; power generation, e.g. tracking sun with solar array;  
security;  
control by programming or voice control; [3 max]
- (b) *Award [1] for each distinct correct point in an explanation of why programmable interface controllers (PICs) are particularly suitable for controlling a smart home.*  
they have multiple inputs/outputs;  
so they are easy to interface with a variety of input and output devices;  
they have a data storage capacity;  
  
they are controlled by software not hardwiring;  
they are reprogrammable;  
this means they can be upgraded according to system need; [3 max]

**B7.** Award [1] for each of three distinct correct points in an explanation of the importance of global standards for digital electronic products, and [1] for each of three distinct correct points in an explanation of the benefits for users and [1] for each of three distinct correct points in an explanation of the benefits for manufacturers [3 max] for each way [9 max].

The importance of global standards for digital electronic products [3 max]:

reduces signals to binary/0s and 1s;  
generic standards;  
supports converging technology;

Benefits for users [3 max]:

reduced costs of products;  
increased versatility;  
a variety of devices can communicate exchange data (e.g. computer, phone, camera, personal organiser, a variety of music players, hand held GPS);  
increased functionality;

Benefits for manufacturers [3 max]:

reduce development costs/increases interoperability of different devices;  
reduced material costs;  
reduced distribution costs;

reduced need for holding stocks of a wide range of components;  
removes delays in production;  
reduces warehousing costs;  
reduces money tied up in stock;

[9 max]

**Option C – CAD/CAM**

- C1.** (a) *Award [1] for stating one advantage of wire frame modelling for the manufacturer.*  
can see internal design structure of the ring;  
relatively simple model;  
fast to produce and modify;  
can rotate the object to new desired views;  
can see how the diamond is fitted into the setting;  
provides coordinates for CAM; **[1 max]**
- (b) *Award [1] for each point in an outline of one advantage of the solid model for the client [2 max].*  
good communication tool with non-specialist audience;  
the customer can see exactly what the ring will look like;  
can see how different stones would look in the ring;  
can explore options without using resources;  
the design can be “tweaked” and new images produced quickly;  
the designer and the customer can discuss the design/the customer becomes part of the design team; **[2 max]**
- (c) *Award [1] for each of three distinct correct points in an explanation of one implication of the use of the CAD model of the ring for cost effectiveness of production [3 max].*  
reduction in tooling costs/labour costs/energy costs/material costs;  
ring can be produced virtually and discussed with client;  
ring only produced after design confirmed;  
  
links to CAM;  
production costs minimized;  
there are no test pieces;  
  
supports mass customization;  
ring design can be resized easily and customized to the client’s specific requirements;  
different options for surface textures/materials/stones can be explored; **[3 max]**

- C2.** (a) *Award [1] for stating one way in which CAM has impacted negatively on the workforce.*  
unemployment;  
24/7 working;  
change in nature of jobs;  
change in requirement for education/training; **[1 max]**
- (b) *Award [1] for each point in an outline of one way in which CAD supports flexible working [2 max].*  
use of laptops and mobile communication systems;  
enables designers to work on the move from anywhere in the world;  
  
designers can work from home;  
at the time that suits them; **[2 max]**
- C3.** (a) *Award [1] for each of two distinct correct points in a description of what the colours on Figure C2 mean [2 max].*  
red bits indicate high stresses;  
blue/green bits indicate low stresses; **[2]**
- (b) *Award [1] for each point in an outline of how the FEA image data shown in Figure C2 would be used by a designer [2 max].*  
the design would be modified;  
to reduce the stresses to ensure product safety; **[2]**
- C4.** *Award [1] for each point in an explanation of each of two limitations of being able to rapid prototype the object in Figure C3 by using LOM rather than other rapid prototyping techniques [3 max] per limitation [6 max].*  
internal structure of a product;  
cannot be represented using LOM;  
appearance prototyping not functional prototyping;  
  
number of components;  
LOM more effective where number of components small;  
not good for complex products;  
  
poor surface finish;  
need for further treatment to get good surface finish;  
*e.g.* sanding;  
  
takes a long time to assemble;  
stair stepping between layers;  
can cut material at an angle to avoid this; **[6 max]**



- C5. (a)** *Award [1] for each point in an outline of one way in which the use of a single-task robot might be considered cost-effective by a small company [2 max].*  
 good for simple, repetitive tasks;  
 can replace human labour and achieve cost savings;
- in extreme environments;  
 saves having to put a human at risk;
- relatively cheap;  
 return on investment can be achieved quickly;
- can integrate the robot into an existing production system using people;  
 no need to invest in a complete/expensive new production system; **[2 max]**
- (b)** *Award [1] for each point in an outline of one way in which the use of a multi-task robot might be considered to be cost-effective by a company which batch produces different components [2 max].*  
 reprogrammability;  
 can do a number of different tasks on an assembly line; **[2]**
- (c)** *Award [1] for each point in an outline of how a team of robots contributes to assembly-line production [2 max].*  
 team would be sequenced along the assembly line;  
 undertakes a series of tasks in the assembly of the product;
- inbuilt quality control;  
 low tolerances; **[2 max]**

- C6. (a)** *Award [1] for identifying a relevant point of comparison relating to the use of CAM and KD fittings to more traditional manufacturing techniques for the manufacture of the kitchen cabinet and [1] for a relevant point about CAM/KD fittings and [1] for a relevant point about traditional manufacturing techniques [3 max].*

<b>Aspect:</b>	<b>Use of CAM/KD fittings</b>	<b>More traditional manufacturing techniques</b>
costs;	cheaper to produce using CAM and KD fittings;	much more expensive as it takes longer;
assembly;	easy for customer to assemble so often used for flat-pack furniture;	generally assembled by craftsperson;
quality control ;	consistent as controlled by computer;	relies on skill/attitude of people;

**[3 max]**

- (b) *Award [1] for each of three distinct correct points in a discussion of one issue relating to the use of MDF in the manufacture of the kitchen door for the kitchen cabinet using CAM [3 max].*

poor quality finish;  
needs finishing;  
*e.g.* use of veneer;

safety;  
MDF gives off potentially toxic dust during manufacture;  
appropriate safety measures need to be put in place;

range of cutting/joining techniques;  
MDF cannot be used with a wide range of techniques;  
limits the scope of the designer;

product life cycle;  
MDF not as durable as solid timber;  
will become damaged more easily in use/obsolete in a short time;

**[3 max]**

**C7.** Award [1] for each of three distinct correct points in a discussion of the use of computer-integrated manufacture (CIM) for a car manufacturer [3 max] for each of three advantages/disadvantages [9 max].

Advantages:

can operate just-in-time (JIT) system;  
raw materials/third part components ordered to requirements;  
no need for storage facilities (parts/products);

vehicle produced to customer order and specification;  
keeps costs down;  
makes car manufacturer more competitive in the market-place;

assembly checked for quality throughout;  
removes errors;  
reduces wastage;

complete process controlled by machines;  
reduces labour costs;  
makes car manufacturer more competitive in the market-place;

customer satisfaction;  
more opportunities for customization;  
reduces lead time and distribution to customer;

Disadvantages:

set-up costs are high;  
redundancy costs high;  
(re)training costs are high;  
has to be seen as a long-term investment;

integration of machines from different suppliers into CIM system can be problematic;  
different machines (such as CNC, conveyors and robots) use different communication protocols;  
different machines may have different maintenance requirements, e.g. lengths of time for charging/changing the batteries;

staff morale;  
data integrity for machine control is critical;  
needs highly-skilled people to ensure proper safeguards for system;  
jobs are very different;  
causes redundancy/(re)training;

reliability;  
CIM is a highly complex system;  
failure of any part of the system undermines consumer confidence/the whole process; [9 max]

**Option D – Textiles**

- D1.** (a) *Award [1] for stating one aspect of the specification of the material for the kite.*  
high strength to weight ratio;  
does not stretch much;  
not water absorbent;  
fray resistant;  
does not rip;  
easy to cut/join;  
available in a wide range of colours/able to be dyed any colour; **[1 max]**
- (b) *Award [1] for each point in an outline of one aesthetic consideration which makes nylon a suitable material for use in the production of the kite [2 max].*  
the kite requires a brightly coloured material;  
nylon fibres can be produced in a range of colours;  
  
designs are often printed on the material;  
nylon can easily be printed on; **[2 max]**
- (c) *Award [1] for each of three distinct correct points in an explanation of how ripstop characteristics are manufactured into the material [3 max].*  
ripstop nylon has reinforcement threads in a crosshatch pattern;  
or by weaving two or three fine yarns together at intervals;  
this prevents tears/rips in the material from spreading; **[3]**
- D2.** (a) *Award [1] for stating one advantage of designing smart clothing.*  
new markets;  
lots of opportunities for new products;  
potential for innovation; **[1 max]**
- (b) *Award [1] for each point in an outline of one benefit of the manufacturers of fashion clothing collaborating with electronics companies to produce wearable computing garments [2 max].*  
different skills sets;  
collaborative learning opportunities for both partners;  
  
potential to develop new products/markets;  
both companies can benefit from product diversification/market development; **[2 max]**
- D3.** (a) *Award [1] for each of two distinct correct points in a description of the sublimation printing process [2 max].*  
dyes printed onto fabric;  
heat is applied so the dyes sublime (change from solid to gas without passing through a liquid phase) and image formed; **[2]**

- (b) *Award [1] for each point in an outline of one limitation of using the sublimation printing process [2 max].*

durability;

the image fades over time as the dye washes out of the fabric;

image quality;

slight blurriness at the edge of a colour results from diffusion of the gaseous dye through the fabric;

substrate material;

can print directly onto fabric;

[2 max]

- D4.** *Award [1] for each distinct correct point in an explanation of each of two issues relating to the manufacture of silk substitutes [3 max] per issue [6 max].*

silk has unique material properties;

aesthetics/look/feel/drape/absorbency/physiopleasure/comfort/quality;

silk substitutes are inferior and do not have the same material properties;

cost;

although silk substitutes are cheaper;

they do not have the same quality;

there is an elite status associated with silk;

silk was originally only allowed for use by ruling class in China;

its cost has maintained its status;

impact on the silk industry;

traditional skills/practices declining;

due to the reduced market for silk;

[6 max]

- D5.** (a) *Award [1] for outlining one benefit of manufacturers achieving the European Union (EU) flower for their textile products and [1] for a brief explanation [2 max].*

indicates to the consumer that the product has met the most stringent environmental standards;

independently verified and endorsed by the EU;

satisfies the market for “greener products”;

potentially increasing sales;

may be anticipating future legislation;

so pro-active in making changes early so as not to be caught out later;

image;

endorses a pro-active “green” corporate strategy;

[2 max]

(b) *Award [1] for each point in an outline of one environmental issue relating to the dyeing of cotton cloth [2 max].*  
many dyes are toxic;  
their release into the environment through waste water can poison eco-systems;  
careful treatment of effluent from textile fabrics; *[2 max]*

(c) *Award [1] for each point in an outline of one issue relating to the use of pesticides in cotton production [2 max].*  
pesticides are highly toxic;  
negative impacts on people's health/biodiversity;  
  
integrated pest management (IPM) can reduce use of pesticides;  
however farmers need education/training to know how to do IPM; *[2 max]*

**D6.** (a) *Award [1] for each of three distinct correct points in an explanation of one reason why, despite the increased development of new technology, production of many textile products is still labour intensive [3 max].*  
manufacturing plants of textile companies often located in developing countries;  
no minimum wage/low employment protection;  
however it is more cost-effective than buying expensive machinery to automate the production process;  
  
high end of the textile industry involves bespoke tailoring;  
it is labour intensive due to individual nature of design and production processes;  
there is a market where clients are prepared to pay a premium; *[3 max]*

(b) *Award [1] for each of three distinct correct points in an explanation of one benefit of recycling textile products [3 max].*  
reduced consumption of virgin raw materials;  
reduced energy use;  
more cost-effective process;  
  
waste material for landfill reduced;  
greening of textile industry;  
appeals to ecofans; *[3 max]*

**D7.** *Award [1] for each of three distinct correct points in a discussion of each of three ways in which the use of CAD/CAM in the textile industry has helped to minimize waste [3 max] for each way [9 max].*

facilitates the production of complex designs;  
facilitates the development and resizing of designs;  
no need for pattern pieces;

quality control;  
precision cutting;  
lower tolerance on components;  
eliminates human error;

tessellation of product components;  
more components produced per length of fabric;  
maximises the conversion of raw material into product/reduces waste;

allows for mass customization/JIT;  
products made to order;  
no waste as products paid for prior to production so no obsolete shop stock;

**[9 max]**

**Option E – Human factors design**

- E1.** (a) Award [1] for stating which part of the human information-processing system is represented by a physiological action.  
motor processes/output; [1]
- (b) Award [1] for each of two distinct correct points in a description of the sensory process in the human information-processing system [2 max].  
eyes take in information;  
send information to brain for processing; [2]
- (c) Award [1] for each of three distinct correct points in an explanation of the function of memory in the human information-processing system [3 max].  
information from the sensory processes needs to be stored temporarily;  
in order for the brain to decide on what action is to be taken;  
before it sends the information to the motor process; [3]
- E2.** (a) Award [1] for stating one aspect of the “four pleasure framework” that the student continuing to wear his favourite worn out trainers is an example of.  
physio-pleasure;  
psycho-pleasure; [1 max]
- (b) Award [1] for each point in an outline of one reason why the “four pleasure framework” is considered part of human factors design [2 max].  
it relates to the psychological function of products/why people like products;  
psychological factors are part of human factors; [2]
- E3.** (a) Award [1] for each point in an outline of one reason related to human factors for the size of the lenses of the Ad-specs [2 max].  
one size fits all;  
large size chosen so suitable for all users/uses; [2]
- (b) Award [1] for each point in an outline of one aspect of the design of the spectacles which has been compromised by the size of the lenses [2 max].  
aesthetics/style;  
the Ad-specs are functional not decorative; [2]



**E4.** Award [1] for each of three distinct correct points in an explanation of each of two physiological human factors issues in relation to the Forest chair [3 max] per factor, [6 max].

comfort;

metal provides a hard surface to the chair;

this may make the chair uncomfortable when sitting for a long time;

the chair may feel very hot/cold depending on the weather conditions;

metal is a very good conductor of heat;

this may make the chair feel uncomfortable when first sitting down;

safety;

the holes could snag clothing;

or pinch the skin/become finger traps for children;

ease-of-use for elderly/infirm people;

the sides of the chair are made from thin metal;

this does not provide much support for hands when a user is pushing him/herself out of the chair;

shape;

the chair is designed to support the back/hips;

but may not be suitable for very large people to fit in it;

[6 max]

**E5.** (a) Award [1] for each point in an outline of one way in which the use of digital humans can contribute to the tests [2 max].

digital humans can be used in a simulation of the car crash;

to provide data on the effects of the crash on different parts of the body;

[2]

(b) Award [1] for each point in an outline of one limitation of using digital humans for the tests [2 max].

people react differently in car crash situations;

depending upon a range of psychological/physiological factors;

it is difficult to simulate precisely how people will react in a car crash;

thus data may not be reliable;

[2 max]

(c) Award [1] for each point in an outline of one way in which digital humans can increase the speed of the product cycle [2 max].

products can be developed more quickly;

more design iterations in less time;

data concerning human factors can be collected more quickly;

and fed into the product development cycle;

use of digital humans is quicker in tests;

tests with physical models would take much longer;

[2 max]

**E6.** (a) *Award [1] for each of three distinct correct points in an explanation of one human factors issue in relation to the design of a railway carriage for a wheelchair user [3 max].*

access;

there is usually a gap between the platform and the carriage;

wheelchair users would need a ramp/lift/helper;

circulation space within the carriage;

so the wheelchair user can manoeuvre the wheelchair;

to locate the wheelchair in a safe position;

safety;

emergency controls/sensors;

at a height suitable for wheelchair users to reach;

facilities;

toilets/tables/luggage racks;

must be designed for ease-of-use by wheelchair users;

**[3 max]**

(b) *Award [1] for each of three distinct correct points in an explanation of one limitation of relying on information from the Internet for the purchase of a new wheelchair [3 max].*

the Internet focuses on marketing information;

the information is provided by companies selling the product;

information will probably focus on advantages and may not identify any disadvantages;

there is an abundance of information about products;

this could lead to confusion/information overload;

this may not help the consumer to find what they want;

consumers may misinterpret/misunderstand the information;

they may then purchase the wrong type of product;

this may not suit their needs;

lack of personal dialogue with a sales person;

may limit the opportunity to discuss the consumer's needs;

a purchase may not be made/a wrong purchase may be made;

**[3 max]**

**E7.** Award [1] for each of three distinct correct points in each of three safety issues concerning the use of the grill [3 max] for each advantage [9 max].

height of the grill;

may not be at eye level for all users;

some users may have to stand on tip-toe to see if food cooked;

accidents more likely to happen;

eye-level means that the face and eyes are at the same height as the grill;

hot fat may spit out from the grill;

could hit eyes/face and cause injury;

with the grill at eye-level;

smoke from the grill could get into the eyes;

this may cause an accident;

to use the grill pan;

users have to hold the grill at head height;

this puts strain on the arm;

grill pan handle;

could get hot as near the heat source;

so burn the skin of the user;

pulling the grill pan from the grill with hot grilled food;

puts strain on muscles;

could cause an accident;

[9 max]

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