



# **MARKSCHEME**

**May 2012**

**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 shown 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 **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. When marking, indicate this by adding **ECF** (error carried forward) on the script.
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 units or significant figures, unless it is specifically referred to in the markscheme.

**Option A — Food science and technology**

- A1.** (a) *Award [1] for stating one reason why the pasteurisation process extends the shelf life of milk.*  
 it kills off the bacteria in the milk;  
 (do not accept “kills off bugs”) **[1]**
- (b) *Award [1] for each of two correct distinct correct points in an outline of one way in which Ultra Heat treatment (UHT) affects the organoleptic properties of milk [2 max].*  
 changes the taste/tainted;  
 burning of sugars sweetens the taste; **[2]**
- (c) *Award [1] for each of three correct distinct points in an explanation of why powdered (dried) milk has such a long shelf life [3 max].*  
 dried milk has a low water activity;  
 bacteria/microorganisms cannot grow in low water activity conditions;  
 therefore the milk does not undergo microbiological spoilage/has a long shelf life; **[3]**
- A2.** (a) *Award [1] for stating one advantage of making crops resistant to the herbicide Roundup™ Ready.*  
 if a crop is Roundup™ resistant it can grow even if treated with the herbicide Roundup™;  
 farmers can treat fields with Roundup™ to destroy weeds/other vegetation knowing that the crop will continue to survive/grow; **[1 max]**
- (b) *Award [1] for one way in which consumer attitudes may impact on the development of Roundup™ Ready crops and [1] for a brief explanation [2 max].*  
 consumer awareness:  
 consumers have more information related to agricultural practices;  
 relating to health/environment/cost;
- values:  
 some consumers may not wish to buy any food which is not natural/has been genetically modified; **[2 max]**

**A3.** (a) Award [1] for a reason for the increasing popularity of foods such as Pot Noodle and [1] for a brief explanation [2 max].

cost;  
they are relatively cheap;

convenience;  
no preparation/limited cooking equipment required;

cooking skills;  
easy to prepare/no knowledge/experience required;

shelf-life;  
dried food, therefore long lasting/can be stored for extended periods;

availability of microwave ovens;  
for quickly heating pre-prepared (fast) foods;

lifestyle;  
fast pace of life requires fast food;

[2 max]

(b) Award [1] for each of two correct distinct points in a description of how market testing would be used in the development of the Pot Noodle food product [2 max].

to ensure that the food product meets the needs of its market;  
appropriate flavour/texture characteristics (level of spiciness, etc.);

[2]

**A4.** Award [1] for each of three correct distinct points in a comparison of food allergy and food intolerance in relation to impact on diet [3 max] per issue.

|  | <b>Food allergy</b>  | <b>Food intolerance</b>                         |
|--|--|---|
| <b>Nature of reaction</b>                | hypersensitivity to dietary substances;                                  | an adverse food-induced reaction;               |
| <b>Effect on the body</b>                | provokes an immune response;   | does not involve the immune system;             |
| <b>Timescale of reaction</b>             | acute/extreme reaction;  | chronic reaction/builds over time;              |
| <b>Level of contact with food stuffs</b> | cannot come into contact with any of the food stuff that is allergic to; | can choose to eat a limited amount of the food; |
| <b>Specificity</b>                       | individual food allergy;   | range of foods with common elements;            |
| <b>Labelling requirements</b>            | mandatory;   | not mandatory;                                  |

[6 max]

A5. (a) Award [1] for listing each of two symptoms of food poisoning [2 max].

nausea;  
vomiting;  
diarrhoea;  
stomach cramps;  
abdominal pain;  
loss of appetite;  
a high temperature (fever) of 38°C (100.4°F) or above;  
muscle pain;  
chills;

[2 max]

(b) Award [1] for one way in which food poisoning can be avoided and [1] for a brief explanation [2 max].

preventing contamination of food with food poisoning bacteria;  
through good personal hygiene/clean food preparation surfaces and utensils/avoiding cross-contamination from raw to cooked foods;

preventing the growth of food poisoning bacteria in food;  
through storing outside the temperature danger zone/preserving food properly;

cooking/reheating food;  
at a core temperature above 63°C/not all foods can be reheated safely;

[2 max]

(c) Award [1] for one way in which the popularity of barbequed (BBQ) food contributes to an increased incidence of food poisoning and [1] for a brief explanation [2 max].

cooking temperature;  
difficult to control;

food is left outside;  
it gets warm and bacterial growth can occur/can lead to external contamination;

skill and experience;  
people who normally do not cook meals may BBQ food/ are ignorant of the possibilities of food poisoning;

[2 max]



**A6.** (a) Award [1] for each of three correct distinct points in an explanation of the geographical distribution of countries with more than 35% undernourishment in the total population in the map shown in Figure A4 [3 max].

all located in Central Africa/least-developed countries;  
low yields of crops from subsistence farming on marginal lands;  
political instability/weak governments/war/drought/poor education/poverty means solutions not found;

[3]

(b) Award [1] for each of three correct distinct points in an explanation of the role of the Food and Agriculture Organization (FAO) of the United Nations (UN) in combating food insecurity [3 max].

the FAO acts as a forum for nations to debate/agree policy;  
provides technical information to countries that allow them to modernize/improve food production;  
provides funding for countries to develop/implement their food production strategies to achieve food security;

[3]

**A7.** Award [1] for each of three correct distinct points in an explanation of why it is important for governments to raise public awareness of food-related health issues with reference to moral, social and economic responsibilities [3 max] for each factor.

Moral responsibilities:

raising public awareness of the issues can encourage better eating habits;  
this will result in a better quality of life;  
and reduced incidence of disease;

Better eating habits:

lower incidence of food-related health issues;  
better quality of life;

Economic responsibilities:

educating consumers regarding food-related health issues allows them to take responsibility for themselves when choosing diet;  
reduces the pull on human resources/healthcare;  
allows these resources to be allocated elsewhere;

Social responsibilities:

provide networks of care/advice;  
food can cause chronic health problems in certain social groups;  
but also have a wider impact on society as a whole;

School programme/health care visitors/health education:

uses a variety of media to get the message across;  
targeting particular social groups e.g. young consumers;

Food can cause acute health problems e.g. food poisoning:

a large number of people can be involved at any point in time if a hotel, restaurant or public institution is involved;  
this can overwhelm health services;

[9 max]

**Option B — Electronic product design**

- B1.** (a) Award [1] for stating the name of Component A.  
transistor; [1]
- (b) Award [1] for identifying the purpose of Component P1 in relation to the exterior solar lamp and [1] for a brief explanation [2 max].  
variable resistor;  
it allows the user to determine the light level at which the lamp switches on; [2]
- (c) Award [1] for each of three correct distinct points in an explanation of how the operation of a comparator in the circuit in Figure B2 influences the type of output saturation [3 max].  
saturation can be positive or negative;  
if the non inverting input is of a higher voltage, the output of the op-amp should saturate positive (+V);  
if the non inverting input is of a lower voltage, the output of the op-amp should saturate negative (-V);  
  
when the light level drops R (LDR) increases and voltage at input 2 of the comparator falls;  
when the voltage (at pin 3) drops below the pre-set voltage the inverting action of the amplifier causes the output voltage to rise;  
the very high gain ensures that it rises to saturate at the positive supply voltage; [3 max]
- B2** (a) Award [1] for a definition of product stewardship to the effect of:  
everyone involved in making, selling, buying or handling electronic equipment takes responsibility for minimizing environmental impact of the equipment at all stages in the life cycle; [1]
- (b) Award [1] for each of two ways in which manufacturers can meet the aims of product stewardship [2 max].  
products can be more easily disassembled;  
products can be more easily recycled;  
use less toxic and more recycled/recyclable materials;  
products can be made to last longer;  
develop collection and recycling infrastructure;  
integrate costs for collection and recycling into the product price;  
take back policy; [2 max]

- B3.** (a) *Award [1] for each of two correct distinct points in a description of how the system shown in Figure B3 operates [2 max].*  
when a car moves over the wire, it alters the magnetic field;  
the sensors in the system computer detect a change in the input current;
- the car alters the frequency of oscillation;  
the computer detects the change in frequency; **[2 max]**
- (b) *Award [1] for identifying one limitation of the use of the underground electrical wire for other road users and [1] for a brief explanation [2 max].*  
bicycles would not affect the magnetic loop;  
the traffic light output would not change/they will be stuck for a while; **[2]**
- B4.** *Award [1] for each of two distinct issues and [1] for each point relating to each issue when considering implementing an information transfer system using copper wires [3 max] per issue.*  
copper wires have limited bandwidth;  
can only support a limited number of users;  
are therefore not cost effective;
- copper is a limited resource;  
copper wire is relatively expensive;  
recycled copper is not appropriate for this application;
- electrical noise is electromagnetic;  
making copper wire vulnerable to interference;  
limiting its capability to transfer information;
- copper cables suffer significant Ohmic loss;  
signal amplifiers are required;  
so signals can be transmitted over long distances;
- copper is a soft metal;  
it needs protecting from external damage;  
regular maintenance is required; **[6 max]**

- B5.** (a) *Award [1] for stating one way in which converging technology encourages planned obsolescence and [1] for a brief explanation [2 max].*

products enhanced with converging technology will have many sensitive electronic components;  
there is a likelihood of a failure of one of the components causing the product to become obsolete;

converging technology products combine the function of two or more products;  
consumers will want to update their products, which shortens the product life-cycle;

[2 max]

- (b) *Award [1] each for listing two ways in which converging technology can benefit national defence [2 max].*

data linkage/threat anticipation;  
unmanned combat vehicles;  
war fighter education/training systems;  
chemical/biological/radiological/explosive threats;  
non-drug treatments to enhance human performance;  
applications for human machine interfaces;

[2 max]

- (c) *Award [1] for identifying an advantage of converging technology for hearing aids and [1] for a brief explanation [2 max].*

increased miniaturisation;  
power efficiency/battery lasts longer;

more sensitive;  
more appropriate to certain types of hearing loss conditions;

[2 max]

- B6.** (a) *Award [1] for each correct distinct point in explanation of how the use of smart technology can conserve water use in the home [3 max].*

smart technologies can provide information/feedback for consumers relating to water consumption for particular products in the home;  
so consumers can monitor their water usage;  
make decisions relating to conserving water for particular appliances;

Smart technologies can control water usage for particular products;  
Sensors can control valves to allow hot and cold water to flow into a product as preset by the consumer;  
When the set limit is reached, the valves close and stop water flow;

[3 max]

- (b) Award [1] for suggesting a correct reason and [1] for each correct distinct point in an explanation of how the use of smart technology to operate windows or blinds in the home can contribute to the comfort of the occupants [3 max].

ventilation;

the smart technology can be used to monitor air temp./circulation and operate the windows/blinds from a pre-determined settings;  
which can stabilize the temperature;

convenience;

the smart technology will automatically open and close windows;  
depending on the needs of particular users;

[3 max]

- B7.** Award [1] for each of three correct distinct points in a discussion of three reasons why Programmable Interface Controllers can be considered sustainable technology [3 max] per reason.

extend the life of the product;

through downloading software upgrades/reprogrammable;  
enabling enhanced functionality;

reduced amounts of raw materials;  
low volumes of silicon are used in their production;  
which is non toxic/readily available;

low energy usage;  
reduces battery consumption during life;  
fewer batteries are used;

allows miniaturization;  
reduced number of components;  
less material required for encasing the product/reduces waste for landfill;

[9 max]

**Option C — CAD/CAM**

- C1.** (a) *Award [1] for stating one disadvantage of a subtractive process.*  
it produces waste material; [1]
- (b) *Award [1] per correct distinct point in an outline of how the CNC machine settings would need to be changed to cut thin card rather than plastic [2 max].*  
feed speed could be increased;  
with same power setting;  
  
power of laser could be reduced;  
at same feed speed; [2 max]
- (c) *Award [1] for each correct distinct point in an explanation of one advantage of using a laser cutter rather than a CNC router to make the sign in Figure C1 from a thermoplastic in relation to quality of finish of the lettering [3 max].*  
only one cut is needed with a laser cutter/laser more accurate;  
while a CNC router would use multiple paths;  
so the laser cutter produces a smoother surface finish; [3]
- C2.** (a) *Award [1] for stating one benefit of CAD for a multinational company with design teams in different parts of the world.*  
project can be worked on 24 hrs a day/shorter lead times on designs;  
ease-of-access to the design work/team members can access the work away from the office;  
more cost effective working/less travelling; [1 max]
- (b) *Award [1] for each correct distinct point in an outline of one limitation of the nature of the design work if the design teams never meet face-to-face [2 max].*  
spontaneity/social interaction/team dynamics can stimulate ideas;  
which wouldn't happen when working in isolation;  
  
no discussion/argument about ideas;  
they might not fully understand the design;  
  
techniques/strategies that the designers can use to stimulate ideas;  
which would not be appropriate when working remotely (e.g. brainstorming);  
  
team members would not be able to manipulate physical models/prototypes together;  
discussion would relate to manipulation of graphic models; [2 max]

**C3.** (a) *Award [1] for each correct distinct point in a description of the relationship between the X, Y and Z axis of the CNC router and the manufacture of the part in Figure C3 [2 max].*

X and Y axis control the direction of cut;

Z axis controls the cutting depth;

X and Y axis work in horizontal plane;

Z axis is the vertical plane;

*[2 max]*

(b) *Award [1] for each correct distinct point in an outline of one way in which the machine tool step variable will determine the quality of the chair seat shown in Figure 3 when using a ball nose cutter [2 max].*

the machine step variable controls the quality of the cut and the surface finish;

if reduced the surface finish will be of higher quality;

the machine tool step variable/stepover should be reduced;

in order to reduce the ridge size/stepover distance to create an accurate profile/shape;

*[2 max]*

**C4.** Award [1] for each correct distinct point in a suitable explanation of two differences between haptic technology and virtual reality [3 max] per difference.

feedback;

user has more control over the environment with haptic technology;

the virtual reality environment is pre-determined;

feedback;

in haptic technology mechanical actuators apply force to the user so s/he can feel the action;

in virtual reality the action is all visual;

the environment can stimulate changes/decisions by the user;

so with haptic technology response time is improved;

a virtual reality environment requires the user to be more passive;

haptic technology provides feedback on the users' movements/physiology which is not possible with virtual reality;

this provides the designer with detailed information about how the user physically interacts with the environment;

which would be very difficult to replicate without the use of haptic technology;

**[6 max]**



**C5.** (a) *Award [1] for identifying one limitation when using natural timber in CAM and [1] for a brief explanation [2 max].*

porosity/warping/stability;  
can make fixing material to the machine bed difficult;

the timber grain is not uniform;  
knots/denser timbers increase tool wear/tearing of the grain could occur;

quality of the surface finish;  
needs post machining finishing/difficult to get uniformity in mass production; **[2 max]**

(b) *Award [1] for each correct distinct point in an outline of one health and safety issue associated with using MDF as a modeling material in a CNC routing system [2 max].*

creates fine particles of dust;  
can cause problems with respiration/skin irritation/carcinogenic/need to wear safety masks; **[2]**

(c) *Award [1] for each correct distinct point in an outline of one quality control issue associated with using metals in a CNC Milling system [2 max].*

tool must be sharp;  
to ensure high quality surface finish;

the correct tool required for the type of metal;  
to avoid the tool wearing excessively;

feed speed must be correct;  
to avoid heat damage to part (blueing);

coolant must be used;  
to ensure high quality surface finish; **[2 max]**

**C6.** (a) *Award [1] for each correct distinct point in a discussion of one advantage of using robots to weld the vehicle in Figure C6 in relation to quality control [3 max].*  
robots work to very small tolerances/robots do not fatigue;  
they can accurately perform repetitive actions;  
each weld will be the same;

robots are equipped with sensors;  
they measure the quality of the weld as they work;  
they can detect very small defects in welds;

*[3 max]*

(b) *Award [1] for each correct distinct point in a discussion of one reason why it may be cost effective for a company to replace the human workforce with robots [3 max].*  
robots are expensive;  
high capital investment;  
the cost can be spread across many products due to increased volume production;

robots can work 24hrs, 7 days a week;  
increased quality control;  
fewer defects/less waste;

lower labour costs;  
less outlay on human facilities needed;  
can work in hazardous conditions;

*[3 max]*

**C7.** Award [1] for each correct distinct point in a discussion of each of three issues for the design of the flat pack furniture shown in Figure C7 in relation to its manufacture using CNC machinery [3 max] per discussion of each issue.

efficient use of material is required to minimise costs;  
nesting of components helps to reduce wastage;  
a common thickness of material is often used;

size and range of tooling available;  
to design beyond their capabilities;  
without the expense to design and make specialist tooling;

maximum machine bed size;  
to make efficient use of sheet material;  
and not design parts larger than the capabilities of the machine;

the designer must consider the range of fixings available;  
by using standard components;  
costs can be reduced;

edges of material will require finishing after machining;  
to enhance the aesthetics of the product;  
and add protection against possible damage;

the veneer will be very thin;  
the designer must ensure that the product can be manufactured with the CNC equipment without damaging the veneer;  
the designer must consider how to fix the material in place when using the CNC machine;

[9 max]

**Option D — Textiles**

- D1.** (a) *Award [1] for stating one reason why retailers might choose the Supertag rather than the Unisen Duraltag.*  
visibility/you can see it more easily;  
deters consumer theft;  
ease of handling by retail staff; **[1 max]**
- (b) *Award [1] for each correct distinct point in an outline of one reason why the tagging systems are only suitable for a limited range of soft goods [2 max].*  
the pin makes a hole;  
which may cause damage to some fabrics;  
  
the weight of the tag;  
can distort fabrics with low dimensional stability; **[2 max]**
- (c) *Award [1] for each correct distinct point in an explanation of why the tagging systems are more popular with department stores than small shops [3 max].*  
staffing levels;  
small shops tend to have a better ratio of staff to customers;  
so supervision of customers is easier and negates the need for the tags;  
  
layout;  
department stores tend to have a large amount of garments on display;  
customers can mingle freely between displays/racks;  
small shop layout is more compact and easier to oversee;  
  
customer service;  
small shops may provide a more personal service;  
they do not want to give the impression they expect customers to steal;  
  
cost;  
small shops may not be able to absorb the cost of the system;  
due to a small turnover of products/the price products are sold; **[3 max]**

- D2.** (a) *Award [1] for stating one limitation of the disposal of synthetic textiles into landfill sites.*  
synthetic textiles do not easily decompose;  
synthetic textiles contain toxic chemicals/materials; **[1 mark]**
- (b) *Award [1] for each correct distinct point in an outline of one advantage of reuse rather than recycle in relation to cotton products [2 max].*  
easy to do;  
can pass them on to other people/charity shops;
- better for the environment;  
no processing needed; **[2 max]**
- D3.** (a) *Award [1] for a correct point and [1] for clarification relating to one advantage of using CAD to design the fabric [2 max].*  
feedback from the client;  
designs can be altered easily and customised;
- simulate the fabric in the clients environment (using virtual reality);  
ensure it meets the client's needs before production;
- quicker/cheaper to design;  
shorter lead time; **[2 max]**
- (b) *Award [1] for a correct point and [1] for clarification relating to one issue that the designer must consider when designing the fabric for production using CAM [2 max].*  
compatibility with software/hardware/complexity of design;  
otherwise the design will not be able to be manufactured by CAM/may provide a poor quality product;
- suitability of design/chosen material;  
must suit machining processes;
- capability of the CAM machine in relation to the size of machine;  
the design must be able to work at the intended scale; **[2 max]**

**D4.** Award [1] for each correct distinct point in a discussion of two disadvantages of the method of producing stain resistant carpets [3 max] per disadvantage.

type of chemicals used in the treatment;  
can be hazardous to manufacturer/user/pets;  
chemical waste is produced;

maintenance;  
limited product life;  
the user has to pay for it to be reapplied at intervals;

cost;  
an additional stage;  
applying chemicals will add to cost;

[6 max]

**D5.** (a) Award [1] for a correct point and [1] for a brief explanation relating to one way in which wearable computing can be used to monitor medical conditions [2 max].

a heart/temperature/blood pressure monitor;  
logs data patterns over an extended period;

[2]

(b) Award [1] for each of two considerations for the designer of wearable computing garments.

electronic products generate heat/heat dissipation;  
power management;  
internet/mobile phone connectivity;  
production techniques;  
size range/5-95 percentile to fit most users;  
fashion;  
cost;  
input/output devices/interfaces;  
safety;

[2 max]

(c) Award [1] for each correct point relating to the relationship between value and the consumer in relation to purchasing wearable computing garments [2 max].

the wearable computing garment is more expensive than similar garments that are unwired;  
some consumers will be prepared to pay the extra price because it adds value;

some consumers will reject buying wearable computing garments;  
as they will not see the extra benefit they will get for the added cost;

[2 max]

**D6.** (a) *Award [1] for each correct point and [1] for each clarification of the point relating to the impact on the environment of growing cotton [3 max].*

use of water;

cotton plants need constant water supply/lots of water/irrigation;

water is an increasingly scarce resource/costly;

use of pesticides;

to maximise crop yield;

run off can contaminate land/affect flora and fauna;

the cotton plantation requires large expanses of land;

the local population may be starving;

this land could be used to grow food crops;

**[3 max]**

(b) *Award [1] for each correct distinct point in an explanation of one issue in relation to clean technology for the cotton dyeing process [3 max].*

the dye is often toxic;

needs to be dealt with in an effective manner;

to minimize impact on the environment;

replace environmentally harmful dyes with ones which do not harm the environment;

ensuring that the quality of dye is as good;

so there is not a problem in relation to the waste;

**[3 max]**

**D7.** Award [1] for each correct distinct point in a discussion of three issues relating to branding of sports clothing as a global market strategy [3 max per issue].

image;

the brand logo communicates the company ethos;

the image and the brand is seen as culturally acceptable globally;

product differentiation;

sports clothing market is highly competitive;

the brand helps the product to stand out in the market place;

branding makes marketing more effective;

reinforces the brand identity;

product placement/celebrity endorsement;

copyright/intellectual property;

once the brand has been established/a market pull has been achieved;

companies need to invest in brand protection;

people develop emotional attachments to brands;

which makes the launching of new products under the same brand name more cost effective;

can underpin corporate growth strategy/long term growth;

price/value tend to be expensive;

for some consumers the appeal of the brand is exclusivity;

this makes the product aspirational;

social sustainability;

must have items/peer pressure/teenage pressure on parents;

can lead to social problems such as theft/credit card debt;

[9 max]



**Option E — Human factors design**

- E1.** (a) *Award [1] for stating the adult percentile which would be used to decide the height of the wall unit.*  
5<sup>th</sup> (percentile); **[1]**
- (b) *Award [1] for each of two pieces of anthropometric data required to determine the depth of the base unit to allow users to gain access to the wall mounted electrical socket [2 max].*  
reach/arm length; **[2]**  
abdominal allowance;
- (c) *Award [1] for each correct distinct point in a suitable discussion of how the user would make best use of the kitchen units for storage in terms of efficiency and safety [3 max].*  
heavy items stored in the base units;  
light items in the wall units;  
items most frequently used stored in cupboards with easiest access/near to appliances to be used *e.g.* saucepans in the cupboard nearest to the hob; **[3]**
- E2.** (a) *Award [1] for stating the visual aspect of the design which has been employed to assist the user.*  
colour coding for hot/cold taps; **[1]**
- (b) *Award [1] for each correct distinct point in an outline of one way in which the design of the taps assists users with limited hand movement [2 max].*  
simple lever mechanism;  
no twisting of tap controls/requires minimal motor skills;
- plenty of finger clearance;  
between the lever mechanism and the spout; **[2 max]**

**E3.** (a) *Award [1] for each correct distinct point in a description of how the designer has combined ease-of-use with aesthetics for the printer storage unit [2 max].*

retractable/pull-out shelves;  
with easy access to items;

uniform appearance when the shelves are closed;  
no collision danger when not in use/visual appeal;

easy to grip front of shelves;  
but the handles lie flush with the front of the unit when closed;

**[2 max]**

(b) *Award [1] for each correct distinct point in an outline of one limitation of the storage unit in relation to bodily tolerance [2 max].*

the user has to twist his/her body to reach the printer when seated at the desk;  
which can cause fatigue/injury;

**[2]**

**E4.** *Award [1] for each correct distinct point made as part of a suitable discussion of two user considerations for the adoption of the Maltron keyboard as a mass market product [3 max] per consideration.*

aesthetics;  
the keyboard is an unusual shape;  
which may not fit in with a workstation layout;

intuitive behaviour/ease of use;  
the user will probably be adept at using a conventional (QWERTY) keyboard;  
so will have to unlearn behaviour to use this one;

training;  
the dominant design for keyboards is the QWERTY keyboard/ #the user will need to spend time learning how to use the keyboard;  
and might not feel that the potential benefit of changing to this type of product is worth the effort;

**[6 max]**

- E5.** (a) *Award [1] for each correct distinct point in an outline of which aspect of the four pleasure framework is experienced by an employee wearing a uniform [2 max].*  
socio-pleasure;  
the uniform gives the user identity/part of a group; [2]
- (b) *Award [1] for each correct distinct point in a suitable description of one way in which the design of a mobile phone may promote psycho-pleasure [2 max].*  
use of varied features/newest technology;  
provided the user with a stimulating experience;  
  
emotional attachment;  
some people feel “lost” without their phone; [2 max]
- (c) *Award [1] for each correct distinct point in a description of the relationship between ideo-pleasure and being an eco-fan [2 max].*  
ideo-pleasure is based on a value judgment;  
eco-fans consider eco-design as morally/ethically correct; [2]
- E6.** (a) *Award [1] for each correct distinct point in an explanation of how motion capture can assist designers in the development of clothing for competitive skiers [3 max].*  
motion capture can be used to analyse the skier’s movements;  
designers can then design clothing that is flexible enough to accommodate the skier’s movements;  
this will enhance the skier’s performance; [3]
- (b) *Award [1] for each correct distinct point in an explanation of how motion capture can contribute to the cost-effectiveness of product development [3 max].*  
human simulation in product design enables a product to be developed more quickly;  
there can be more design iterations in less time;  
improved productivity results from enhanced automation of the development process;  
digital prototypes are cheaper to produce than physical prototypes; [3 max]

**E7.** Award [1] for each correct distinct point in a discussion of three issues relating to displacing population stereotypes in the design of controls for products. [3 max] per each issue.

people become used to how controls work for a product:  
they often do not think about how to use the controls;  
but they use them intuitively;

people come into contact with familiar products:  
but sometimes in unfamiliar contexts *e.g.* a telephone in a hotel room;  
if the controls work differently to the product they are most familiar with they may misuse the product/become frustrated with it;

safety:  
if a user assumes a product works in a particular manner;  
they may misuse the controls which could cause a safety problem;  
*e.g.* leaving a gas tap on;  
(accept a suitable example)

[9 max]

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