



MARKSCHEME

NOVEMBER 2010

DESIGN TECHNOLOGY

Higher Level

Paper 3

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 to show that these marks have been transferred to the appropriate square bracket 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 front cover.
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 front cover 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 front cover.**
13. 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 name of the process which causes the dough to double in volume as shown in step 6.*
aeration; [1]
- (b) *Award [1] for identifying a reason for adding yeast to the pizza dough as shown in step 1 and [1] for a brief explanation.*
fermentation/the yeast produces carbon dioxide from the carbohydrate;
the carbon dioxide aerates the dough and increases its volume; [2]
- (c) *Award [1] for each of three distinct correct points in an explanation of why the recipe for the pizza dough would have to be modified so that it would be suitable as part of a gluten-free diet.*
wheat flour contains gluten;
a considerable number of people suffer gluten intolerance/coeliac disease (symptoms include chronic diarrhoea and fatigue in adults and failure to thrive in children);
the wheat flour in the recipe needs to be replaced with a gluten-free alternative, e.g. potato flour or rice flour; [3 max]
- A2.** (a) *Award [1] for stating the Millennium Development Goal relating to food security to the effect of:*
halve, (between 1990 and 2015), the proportion of people who suffer from hunger; [1]
- (b) *Award [1] for identifying each of two criteria for food security.*
sufficient food is available;
supplies are relatively stable;
those in need of food can obtain it; [2 max]

- A3.** (a) *Award [1] for inserting the right numbers into the equation and [1] for a correct answer, including units.*

$$\frac{125}{(1.9)^2};$$

34.62 kg m²;

[2]

- (b) *Award [1] for identifying a reason why governments should raise public awareness of health issues relating to obesity and [1] for a brief explanation.*

increased risk of a range of serious health issues (e.g. high blood pressure, diabetes, heart disease, stroke, cancer);
resulting in long-term illness;

social responsibilities of government;
informing of the potential for premature death;

they put pressure on the health services for long-term care;
this can cost the government a lot of money;

obesity causes low self-esteem;
this can lead to depression and added pressure on health services;

moral responsibility;
to educate/inform people of health risks/lifestyle choices;

[2 max]

- A4.** *Award [1] for identifying and [1] for each of two distinct correct points of explanation.*

Market pull:

finding a market is critical to new food product development;
market pull results from consumer demand;
consumers want more choice, more convenience, cheaper foods, longer shelf lives;

Technology push:

new technologies can enable food product innovation;
this can lead to new food products, e.g. snack foods, convenience foods;
or it can lead to the enhancement of existing food products, more convenient, longer shelf lives;

[6]

- A5.** (a) *Award [1] for each of two distinct correct points in a description of high-risk foods.*
 foods which support the growth of food poisoning bacteria;
e.g. milk, mayonnaise, fish, meat; [2]
- (b) *Award [1] for identifying one reason why uncooked poultry would be kept at the bottom of the refrigerator and [1] for a brief explanation.*
 raw/uncooked poultry can harbor food poisoning bacteria, *e.g.* Salmonella;
 if liquid from the poultry were to drip onto other foods which were not cooked before eating this would result in food poisoning; [2]
- (c) *Award [1] for identifying one reason why cheese and dairy products would be kept at the top of the refrigerator and [1] for a brief explanation.*
 cheese and dairy products are high-risk foods which are often not cooked before consumption/eaten raw;
 food poisoning bacteria would therefore not be killed and could cause food poisoning;

 at the top of the refrigerator they will not be dripped on by other foods;
 risk of contamination by food poisoning bacteria is therefore reduced; [2 max]
- A6.** (a) *Award [1] for each of three distinct correct points in an explanation of an issue of public concern relating to the safety of genetically modified crops.*
 does genetic modification change the food?;
 are genetically modified foods safe to eat?;
 will they cause allergic reactions or other diseases, *e.g.* cancer?;

 what are the environmental impacts of genetically modified foods?;
 will they cause gene transfer to other organisms?;
 will this contaminate the natural gene pool?; [3 max]
- (b) *Award [1] for each of three distinct correct points in an explanation of the importance of the acceptance by the general public in establishing a market for a food product.*
 people are naturally wary of new food products;
 if the food product were not accepted rapidly enough then it would not be commercially viable;
 attitude to new food products is affected by a variety of factors *e.g.* culture, religion, *etc.* [3]

A7. *Award [1] for each of three distinct issues relating to the effectiveness of legislation governing food labelling as a means of altering diet [3 max] for each issue.*

dietary habits are a combination of culture and habit;
food habits are very resistant to change;
individuals must choose to change and food labelling is unlikely to have much impact on consumer decision-making;

food labels provide a range of information;
this information may not be readily understood by consumers;
labelling relates to a specific product not to how that product is used as part of a balanced diet/in combination with other ingredients/food items;

many government initiatives, *e.g.* the traffic light system, focus on fat, fibre, sugar and salt intakes;
these relate to issues of high public concern, *e.g.* heart disease and diabetes;
public reaction against the “nanny state” so that people ignore the information on the label;

different supermarkets provide labelling in different ways;
some ways may be less easily understood by consumers;
this can lead to confusion;

some labelling is not related to legislation *e.g.* “farm assured”;
but manufacturers/retailers use the label as a form of promotion/quality assurance and place the label in a prominent position;
consumers may only notice this type of label and not others hidden on the back of the package;

many consumers purchase their food regularly from large retailers *e.g.* supermarkets;
they place trust in the retailer to ensure food complies with legislation;
so do not feel the need to examine labels themselves;

consumers need to be aware of what to look for on a label;
many consumers are ignorant of this issue;
labels based on legislation are usually not very prominent on packaging;

many consumers are pressed for time when shopping;
and may be distracted by other things *e.g.* conversations with people, looking after their children;
so they do not have the time/opportunity to examine the labels on products;

[9 max]

Option B — Electronic product design

B1. (a) Award [1] for stating the logic gate labelled X in Figure B1.

AND gate;

[1]

(b) Award [1] for a correct response to E and [1] for a correct response to F.

B	A	E	F
0	0	1	0
0	1	1	1
1	0	0	0
1	1	0	0

[2 max]

(c) Award [1] for each distinct correct point in an explanation of the combination of switches needed to be pushed to open the lock mechanism.

A, C and D;

NOT B,

F = 1 when A and NOT B = 1;

G = 1 when C and D = 1;

Q = 1 when F and G = 1;

[3 max]

B2. (a) Award [1] for a definition of bit rate to the effect of:

the number of bits/0s and 1s per second produced by a digital system;

[1]

(b) Award [1] for identifying one implication of limited bit rate capacity for a home security system and [1] for a brief explanation.

the bit rate requirement is determined by the resolution of the image, the refresh rate and the number of monitors using the link;

limited bit rate capacity will impact on resolution, refresh rate and or number of monitors;

low bit rate;

longer for system to respond to any data sent;

[2 max]

- B3.** (a) Award [1] for identifying the ratio of R_f to R_a to achieve an amplification of ten times and [1] for a brief explanation.
 R_f must be nine times R_a ;
 $\text{gain} = 1 + R_f / R_a$; [2]
- (b) Award [1] for stating why R_a and R_f should not be very low (e.g. less than 1 k Ω) and [1] for stating why they should not be very high (e.g. more than 10 k Ω).
 if too low then excessive current and energy will be wasted;
 if too high then damp air and other components will affect the ratio; [2]
- B4.** (a) Award [1] for each of three distinct correct point in an explanation of why the component values are suitable for producing a tune of approximately 20 seconds.
 the time constant $T = 0.63 C.R$ seconds;
 $T = 0.63 \times 320000 \times 0.000100$ seconds;
 $T = 20.16$ seconds; [3]
- (b) Award [1] for each of three distinct correct points in an explanation of the effect of connecting 200 μF capacitor in parallel with the 100 μF capacitor on the duration of the logic 0 output.
 $100\mu F + 200\mu F = 300\mu F$;
 $T = 0.63 \times 320000 \times 0.000300$ seconds;
 $T = 60.48$ seconds, i.e. three times as long; [3]
- B5.** (a) Award [1] for each distinct correct point in a description of “The Communicator”.
 a conceptual converging technology;
 it enhances the efficiency of human communication; [2]
- (b) Award [1] for identifying a key element in “The Communicator” and [1] for a brief explanation.
 the avatar or human-like image;
 it learns and changes form to communicate with individuals in the most effective manner; [2]
- (c) Award [1] for identifying a key design considerations in the implementation of “The Communicator” and [1] for a brief explanation.
 high capacity data transfer to network;
 efficient human-machine interfaces; [2]

- B6.** (a) Award **[1]** each for identifying a relevant aspect of digital and traditional celluloid film photography from an environmental perspective and **[1]** for comparing that aspect for digital and traditional photography.

Aspect	Digital photography	Traditional celluloid film photography
Use of chemicals;	can be printed on a laser printer not using toxic chemicals;	uses toxic chemicals;
Printing;	increased selectivity for printing – images are not always printed;	images generally printed, even unwanted ones;

[3 max]

- (b) Award **[1]** for each of three distinct correct points in a discussion of one advantage to the user of digital photography relative to traditional celluloid film photography.

digital images can be enhanced via computer processing;
blemishes, *e.g.* red eye, can be removed;
this was a specialist task with traditional images – airbrushing, *etc*;

digital images can be readily stored/shared;
email attachments or digital networked archives;
this means they can be available globally instantly;

digital cameras have a screen to view the image;
the image can be checked in taking;
if not suitable can be retaken immediately;

[3 max]

- B7.** *Award [1] for each distinct correct point in an explanation of the limitations of an open loop control system [3 max] and how positive and negative feedback [3 max] each are used in a closed loop system to overcome these limitations.*

Limitations of an open loop system:

there is no way of knowing if the output has responded to a change in the input;

the output may be affected by the loading on the system;

no sensor monitors the output and feeds back information about the current state of the output in comparison with the input requirement;

How positive feedback is used:

positive feedback occurs when an effect causes more of itself;

it can be used to make a device oscillate between its maximum and minimum states;

it is used when rapid, decisive switching or oscillation is needed;

How negative feedback is used:

negative feedback is used to correct output errors or to lower output to a pre-determined level;

it is used to stabilise a system;

e.g. the rotational speed of a lathe;

[9 max]

Option C — CAD/CAM

- C1.** (a) *Award [1] for stating one benefit for the manufacturer of using a CNC router for the manufacture of the Ben Wilson Chairfix design shown in Figure C3.*
less waste as parts tessellate together and would still be able to be cut;
accuracy when making pairs/multiples of a shape;
lower cost than conventional means; *[1 max]*
- (b) *Award [1] for each distinct correct point in a description of how the straight cutting tool would be used to make the part in Figure C3 and [1] for a brief explanation.*
straight cutting tool programmed to remove material around each part very accurately;
at right angles to surface of the material; *[2 max]*
- (c) *Award [1] for each for three distinct correct points in an explanation of how the CNC machine aids manufacture.*
accuracy/precision;
repeatable quality;
more effective manufacture;
- global communication systems mean CNC machine data can be sent anywhere in the world;
this means the manufacturer can separate design and manufacture;
manufacturing of product can be completed wherever most cost effective in terms of material or labour costs;
- flexible manufacturing;
CNC machine can be reprogrammed for different products;
reduced down-time between batches or one-off production; *[3 max]*

- C2.** (a) *Award [1] for stating an issue relating to the replacement of the human workforce by robots.*
loss of jobs;
high initial investment;
training issues/different skills set needed;
maintenance costs;
confidence in the market for the product required in order to recoup costs;
loss of skilled workers/traditional skills; **[1 max]**
- (b) *Award [1] for identifying one advantage of using robots in industrial environments and [1] for a brief explanation.*
accuracy;
repeatable quality;

quality control;
precision results in low tolerances;

reduced exposure of human workers to hazards;
robots can operate in high temperature environments and with toxic chemicals;

speed;
robots can speed up production times;

flexibility;
robots can be easily reprogrammed for different tasks;

24/7 operation;
robots do not need to take breaks/holidays/have hangovers; **[2 max]**
- C3.** (a) *Award [1] for identifying the process which would be used to produce the back of the chair shown in Figure C4 from a 2-D sketch and [1] for a brief explanation.*
extrude (3-D effects);
need to specify the height of the extrusion; **[2]**
- (b) *Award [1] for identifying the process which would be used to produce the wheel shown in Figure C5 and [1] for a brief explanation.*
revolve;
360 degrees around an axis; **[2]**

- C4.** *Award [1] for each of three distinct correct points in a discussion of each of two ways in which CAD has affected consumer choice when considering a kitchen design [3 max] per way.*

CAD can produce high quality 2–D images of layouts and designs quickly;
clients are often non-specialists;
the images help the client visualize the design;

the design can be modified easily in discussion with the client;
alternative designs/colours for the different elements of the kitchen can be offered;
virtual modelling reduces wastage of resources/saves time;

consumers can take their time to consider their options;
they can visualise the CAD images on their own computer at home;
allowing a more informed choice/comparison with other ideas;

the CAD package can include automatic updating of costs;
as consumers consider different options;
they can easily compare price with value;

consumers can communicate with the designer/manufacturer electronically;
so they do not need a face-to-face meeting to discuss options;
this gives the consumer much more choice in the marketplace;

[6 max]

- C5.** (a) *Award [1] for identifying one way in which CAD supports flexible working and [1] for a brief explanation.*

working on the move;
laptop;

global mobile communications/advanced data storage;
enables access to data files from any location;

no restrictions of working only during office hours/in time zones;
they can plan their own work schedule within agreed parameters;

more lifestyle choices;
can fit the work around other commitments e.g. looking after children;

[2 max]

- (b) *Award [1] for identifying one way in which CAD has changed the nature of the designer-client relationship and [1] for a brief explanation.*

closer relationship;
client more involved in design process;

exchange of information/ideas throughout process possible;
client has greater awareness of progress/decision making;

[2 max]

- (c) *Award [1] for identifying one way in which CAD has changed the nature of design education and [1] for a brief explanation.*

wider set of sophisticated modelling techniques available;
provides more opportunities for students;

more scope for students;
wider set of skills required;

the process better mirrors commercial design;
gives students a more realistic view of designing/better training;

flexibility of learning;
e.g. can use programmes out of the design studio/classroom *e.g.* in the library;

improved the pace of learning;
students can transfer skills/knowledge from other computer activities to quickly become accustomed to the CAD software;

integrated resources;
students can switch between different software/programmes for R & D;

[2 max]

- C6.** (a) *Award [1] for each of three distinct correct points in an explanation of how modelling wax is used in a CAM system to aid jewellery production.*
modelling wax can be machined on a CAM system;
this produces a master;
the master can then be used for lost wax casting and production of the finished piece;

[3]

- (b) *Award [1] for each of three distinct correct points in an explanation of one issue relating to the use of metal as a material in a CAM system.*

machining metal requires lubrication;
this will reduce tool wear;
feed speed and spindle speed may need to be reduced/takes longer;

metal expands when it gets hot;
on cooling it will contract;
so difficult to ensure tolerances appropriate;

quality of finish;
may not be to required standard;
an additional process may be needed to get the required standard;

[3 max]

- C7.** *Award [1] for each of three distinct correct points in a discussion of three benefits of using rapid prototyping for the designers of electronic products [3 max] for each benefit.*

good for batch and one-off production;
working models can be easily produced;
use for market research/product testing;

reduced costs/lead times;
design developed with CAD;
manufactured cost effective with rapid prototyping;

reduced flexibility in relation to use of materials;
design for materials;
may limit design options;

reduced flexibility in relation to manufacturing strategy;
design for process;
may limit design options;

[9 max]

Option D — Textiles

- D1.** (a) *Award [1] for identifying a reason why care labelling for textile products should be mandatory.*
 consumers, drycleaners and launderers need to select the correct care treatment;
 the useful life of a textile product will be prolonged by using the correct care;
 so that textile products will not be damaged by improper care; *[1 max]*
- (b) *Award [1] for identifying a reason why the care instructions should be accessible at the point of sale and [1] for a brief explanation.*
 consumers need to be aware of how to care for products when they purchase them/consumers need to consider the cost of caring for products when they purchase them;
 if specialist care is required the consumer may prefer not to purchase the product; *[2]*
- (c) *Award [1] for each distinct correct point in an explanation of why there is a need for international standards for care labels.*
 fabrics are global products;
 a garment produced in one country may be sold in another;
 therefore they need to be understood in different language contexts;

 market development;
 garments intended for global markets;
 need to take into account facilities for care of fabrics in different regions e.g. dry cleaning facilities; *[3 max]*
- D2.** (a) *Award [1] for stating one challenge for the designers of wearable computing garments.*
 interfacing with human body;
 comfort of wearable computing garments;
 price;
 electrical connections;
 seams;
 care and maintenance; *[1 max]*
- (b) *Award [1] for identifying one benefit of aligning the wearable computing market more closely with the fashion market and [1] for a brief explanation.*
 lead time for production is shorter for the fashion market;
 shortened lead times reduces production costs;

 reduced prices for products;
 volume production can produce economies of scale/reduce unit costs;

 products must be attractive to users;
 many fashion products are branded and sell well;

 acceptability of the products by consumers;
 the products will be perceived as mainstream; *[2 max]*

- D3.** (a) *Award [1] for identifying one way in which VELCRO[®] is an example of biomimetics and [1] for a brief explanation.*
the idea for the hook and loop system is taken from nature;
it is applied to the development of the VELCRO[®] product; [2]
- (b) *Award [1] for identifying one advantage of using VELCRO[®] for the fastener of the child's trainer shown in Figure D4 and [1] for a brief explanation.*
quick and easy for children to put on and take off;
children may not be good at tying laces or doing buckles;

strong fastening;
remains fastened even under considerable pressure;

flexible fastening;
can accommodate odd shaped feet; [2 max]
- D4.** *Award [1] for each of three distinct correct points in a discussion of two ways in which the use of CAM in the textile industry has helped to minimise waste [3 max] per way.*
nesting of product components;
can identify how to get the most components of the material virtually;
more efficient use of material;

quality control;
reduction in errors;
fewer faulty products;

24/7 working;
CAM machines do not suffer fatigue;
inconsistency of production due to social/health reasons; [6 max]

- D5.** (a) *Award [1] for each distinct correct point in a description of the contribution of the EU flower system to the life cycle analysis of textile products.*
analyses the major environmental impacts at each stage of the production of textile products;
identifies ways in which these impacts can be minimized; [2]
- (b) *Award [1] for each distinct correct point in a description of the process of ginning.*
separation of cotton seeds and fibres after harvesting;
uses a cotton gin (hence the name ginning) or wooden roller to draw out the fibres; [2]
- (c) *Award [1] for identifying an environmental issue related to commercial spinning, knitting and weaving processes and [1] for a brief explanation.*
these are noisy processes;
noise reduction is/workers need to wear ear protection to minimise damage to hearing;

they are dusty processes;
workers need to wear masks to avoid breathing in the dust which can lead to respiratory problems; [2 max]
- D6.** (a) *Award [1] for each distinct correct point in an explanation of one disadvantage of multinational textile companies establishing manufacturing plants in developing countries.*
exploitation of local people;
there may be few alternative opportunities for local people;
often wages are low / conditions are poor / child labour is used;

erosion of culture;
the textile product may not be compatible with the local culture;
this may lead to problems in the local communities;

training;
established training programmes/practices may not be appropriate for the workforce;

management;
employing managers from the host country may be difficult;
persuading existing managers to relocate may be a problem; [3 max]
- (b) *Award [1] for each distinct correct point in an explanation of how corporate social responsibility may overcome the issue identified in question 6(a).*
fair trade approaches;
ensure appropriate remuneration for local people;
provide appropriate education and training opportunities;
ensure good working conditions;
ensure no child labour is employed;
provide management training;
provide incentives for people to relocate; [3 max]

D7. *Award [1] for each distinct correct point in an explanation of three factors that contribute to expansion of the textile industry due to automation [3 max] for each reason.*

global markets;

textile products are now manufactured and distributed world-wide;

automation facilitates mass production for enlarged market;

globalisation;

manufacturers from across the world are able to take on orders;

makes textile market very competitive;

economic considerations;

automation more cost-effective;

reduced cost per garment;

this increases demand for products / increases market;

mass customisation;

sophisticated automation processes allow consumers to customise products;

increases consumer choice/demand;

[9 max]

Option E: — Human factors design

- E1.** (a) *Award [1] for stating one characteristic of a product which becomes a global success.*
 easily understood across cultures;
 perceived need for product;
 “must have” product / provides status to its owner;
 suitable for different market sectors; **[1 max]**
- (b) *Award [1] for identifying one way in which the simplicity of the iPod’s user interface has contributed to its success and [1] for a brief explanation.*
 it is very simple/attractive/intuitive to use;
 so it is not a barrier to success; **[2]**
- (c) *Award [1] for each of three distinct correct points in an explanation of why participatory design involving users helps designers to develop good user interfaces.*
 it is difficult for the designer to understand all users’ requirements;
 a designer needs to look at the product through the eyes of a prospective user;
 interacting with users when they undertake specific tasks enables the designer to understand why an interface may not be easy to learn; **[3]**
- E2.** (a) *Award [1] for a definition of digital human to the effect of:*
 computer simulation of a variety of mechanical and biological aspects of the human body; **[1]**
- (b) *Award [1] for identifying a way that digital humans enable the consideration of human factors early in the design cycle and [1] for a brief explanation.*
 digital humans can be used in design development;
 before a physical prototype is built;

 the design can be optimized for use by people of different sizes/strengths;
 ensures comfort/visibility/access to controls/access and egress/reach/access for maintenance/ensures strength required to operate is within the normal range; **[2 max]**

- E3.** (a) *Award [1] for identifying one reason why affordance is an important consideration in human factors design.*
affordance is a property of an object that indicates how it should be used;
e.g. on doors, handles are for pulling/push plates are for pushing; [2]
- (b) *Award [1] for identifying one reason why the use of the push plate on the right-hand door in Figure E2 is a better design for a door that needs to be pushed than the handle and sign used on the left-hand door and [1] for a brief explanation.*
the push plate on the right-hand door indicates simply that the door should be pushed;
the handle on the left-hand door suggests that the door should be pulled and conflicts with the sign that says push and is confusing for users; [2]
- E4.** *Award [1] for identifying each of two ways in which human factors specialists determine adequate product safety and [1] for each of two distinct correct points of explanation [3 max] per way.*
behavioural testing;
performs a range of activities with the product;
e.g. unpacking, assembly, operation, maintenance;

conceptual testing;
evaluates safety instructions and warning messages;
people are not exposed to hazardous conditions; [6]

- E5.** (a) *Award [1] for identifying one human factor issue related to wheelchair design and [1] for a brief explanation.*

anthropometric dimensions;

the chair needs to be adjustable so that it fits its user;

posture;

the chair needs to enable the user support and a good posture;

comfort;

the chair needs to be adjustable so that it is comfortable for its user;

pressure management;

wheelchair users can get pressure sores from sitting in a poorly designed chair for too long;

accessible controls;

for a wide variety of users;

biomechanics;

force needed to turn the wheel;

[2 max]

- (b) *Award [1] for identifying one way in which designers could research human factors for wheelchair design and [1] for a brief explanation.*

user research methods;

involve wheelchair users and carers in the design process;

research into existing products;

identify design opportunities, e.g. through constructive discontent;

expert appraisal;

consult human factor specialists

[2 max]

- (c) *Award [1] for identifying one benefit of the Internet for wheelchair users and [1] for a brief explanation.*

wheelchair users can purchase a product which precisely meets their needs;

this is likely to be safer;

they can purchase a range of products not just adapted products without the need to visit shops;

this can make life much easier for them in terms of access to some shops;

gain feedback from other wheelchair purchasers;

in order to compare products/make an informed choice;

they can take as long as they want to make a decision;

no pressure selling from sales staff;

[2 max]

- E6.** (a) *Award [1] for each of three distinct correct points in an explanation of one reason why the designers of airport seating might design for discomfort.*
the airport management do not want people to be too comfortable on the airport seating;
this will encourage them not to “nest” and take over areas of an airport lounge preventing others using it;
saves disagreements in relation to territoriality;
encourages people to move around the terminal/visit retail outlets; **[3max]**
- (b) *Award [1] for each of three distinct correct points in an explanation of the importance of international standards in airport signage.*
people fly into airports from all parts of the world;
may not understand local language in a particular airport;
international symbols are easy to understand and overcome the need for textual information;
people are often in a hurry e.g. connecting flights;
so they need to understand signs quickly/while on the move; **[3max]**
- E7.** *Award [1] for each of three distinct correct point in an explanation of each of three advantages of paper prototyping [3 max] per advantage.*
cheap and easy to implement;
it can be quickly and easily modified and retested in the light of user feedback;
designs can be developed quickly;
- it involves users / participatory design / user-centred design;
they represent the target market;
therefore the final design should match the needs of the target market better;
- sophisticated designs often involve multi-disciplinary teams;
paper prototyping promotes communication between team members;
promotes a more holistic approach to the design process;
- no computer programming is required;
therefore it is platform independent;
it does not require programming skills; **[9 max]**
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