M15/4/DESTE/HP3/ENG/TZ0/XX/M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2015

Design technology

Higher level

Paper 3

24 pages

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.

2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.

3. 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.**

4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use RM™ Assessor annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.

5. Personal codes/notations are unacceptable.

6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, use the "ZERO" annotation to award zero marks. Where a candidate has not attempted the part question, use the "SEEN" annotation to show you have looked at the question. RM™ Assessor will apply "NR" once you click complete.

7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. RM™ Assessor will only award the highest mark or marks in line with the rubric.

8. Ensure that you have viewed **every** page including any additional sheets. Please ensure that you stamp "SEEN" on any additional pages that are blank or where the candidate has crossed out his/her work.

9. There is no need to stamp an annotation when a candidate has not chosen an option. RM™ Assessor will apply "NR" once you click complete.

10. 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. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the "CON" stamp.

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.

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 ***WTTE*** (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. 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

1. (a) *Award **[1]** for stating one reason for the selection of a head of wheat for both the gluten-free symbols shown in Figures A1 and A2.*

cereals, *eg* wheat, are a major dietary source of gluten and thus a major problem in relation to gluten intolerance;
the seed head of the plant is an easily recognizable shape and thus a good visual symbol; **[1 max]**

(b) *Award **[1]** for identifying how gluten intolerance impacts on diet and **[1]** for a brief explanation **[2 max]**.*

people who suffer gluten intolerance should avoid foods that contain cereals;
this can be difficult as a lot of processed foods contain wheat flour;

because wheat flour is used widely in processed foods and recipes;
it can be difficult to achieve a varied, interesting and balanced diet;

products containing wheat / gluten in diet need to be replaced;
by gluten free foods; **[2 max]**

(c) *Award **[1]** for each of three distinct correct points in an explanation of why many food retailers have produced ranges of gluten-free foods **[3 max]**.*

gluten intolerance is increasingly common;
food retailers are responding to a distinct market segment;
the size of the market segment makes gluten-free ranges financially viable; **[3]**

2. (a) *Award **[1]** for a definition of genetically modified organism to the effect of:*

a plant or animal in which the DNA has been altered through the insertion of genetic material from another source; **[1]**

(b) *Award **[1]** for each of two distinct correct points in a description of the significance of the FlavrSavr™ tomato **[2 max]**.*

it was the first commercially-grown genetically modified food to be licensed for human consumption;
it became the focus for the anti-GMO lobby; **[2]**

3. (a) *Award **[1]** for each of two distinct correct points in a description of one way in which the packaging of Coca-Cola® has contributed to the development of the Coca-Cola® brand **[2 max]**.*

the red colour/the shape of the bottle/can/the font used;
highly recognizable/distinctive;
are all strongly associated/synonymous with the brand;

the structural design of the packaging is good;
easy to hold/easy to open/recyclable;

aesthetically sound – timeless design;
has provided a consistent image for the product; **[2 max]**

(b) *Award **[1]** for one purpose of food labelling and **[1]** for a brief explanation **[2 max]**.*

to provide nutritional information;
nutritional information is designed to help consumers make informed food choices (*eg* to achieve a balanced diet);

to indicate storage information;
correct storage will maximize the shelf life of the product;

to provide serving ideas;
consumers may not be sure how the product should be used;

to indicate the ingredients used;
especially those that may cause allergies; **[2 max]**

4. *Award **[1]** for each distinct point in an explanation of two principal causes of chemical spoilage of food **[3 max per cause, 6 max]**.*

enzymic spoilage (or autolysis);
living organisms use enzymes to catalyse chemical reactions in its cells;
after harvesting these enzymes can cause the decomposition of the tissue so the food decays;

rancidity;
relates to the fat/oil content of a food;
chemical breakdown of the fat or oil leads to off-flavours in the food; **[6]**

5. (a) *Award **[1]** for identifying the role of market testing in the development of a food product and **[1]** for a brief explanation **[2 max]**.*

to see if the food is attractive to consumers in terms of its texture, smell, colour and form;
to get feedback from consumers to make any final changes to the product before going to full/industrial-scale production;

marketing;
promoting food products to consumers;

distribution;
ensuring that food products reach food outlets and customers; **[2 max]**

(b) *Award **[1]** for a factor that determines the need for primary processing and **[1]** for a brief explanation **[2 max]**.*

storage properties;
to extend the shelf life of the product and prevent spoilage/make food safe;

to reduce volume/weight;
to facilitate distribution/reduce energy costs of distribution; **[2 max]**

(c) *Award **[1]** for the role of food manufacturers in the food chain between the farmer and the consumer and **[1]** for a brief explanation **[2 max]**.*

undertake (secondary) processing of foods;
develop safe products for consumers; **[2]**

6. (a) *Award **[1]** for each of three distinct correct points in an explanation of how the design of food preparation areas can help prevent food poisoning **[3 max]**.*

proper design of food preparation areas will ensure they are easy to keep clean;
so will reduce the likelihood of contamination of food by food poisoning bacteria;
uncracked worksurfaces reduces ingrained dirt and the potential for contamination;

workflow design ensures the separation of raw and cooked foods;
raw food carries food poisoning bacteria;
if not separated can get cross-contamination;

provision of fridges/blast chillers;
keeps food cool/out of temperature danger zone;
prevents the growth of food poisoning bacteria in food;

provision of sinks for hand washing;
ensures that staff can maintain good personal hygiene;
reduces the potential for contamination; **[3 max]**

(b) *Award **[1]** for each of three distinct correct points in an explanation of how an understanding of food poisoning contributes to the design of individual convenience foods **[3 max]**.*

appropriate packaging;
prevents damage in distribution;
prevents contamination;

appropriate storage;
ensures food poisoning organisms do not grow in the food;
ensures food is kept safe;

labelling considerations;
provide instructions to consumers on the correct storage and cooking of the food after purchase;
shelf life/best before information; **[3 max]**

7. *Award **[1]** for each distinct correct point in an explanation of the impact of low intakes of protein, carbohydrate and water-soluble vitamins on the body **[3 max for each nutrient, 9 max total]**.*

Low protein:
stunted growth/muscle wasting;
decreased resistance to infection;
in extreme conditions this can lead to kwashiorkor/marasmus;

Low carbohydrate:
low energy production;
difficulty in undertaking physical activity;
tiredness/lethargy/weight loss;

reduced fibre intake;
constipation and bowel issues;
increased risk of digestive cancers and cardiovascular disease;

Low water-soluble vitamins:
B vitamins;
low energy production;
difficulty in undertaking physical activity;
deficiency leads to tiredness/lethargy;
vitamin B1/Thiamine;
deficiency leads to beriberi;
vitamin B2/Riboflavin;
deficiency leads to cataracts/sore tongue/dermatitis;
vitamin B3/Niacin;
deficiency leads to cramps and nausea;
vitamin B6/pyridoxine;
deficiency leads to anaemia and kidney stones;
vitamin B12/cobalamin;
deficiency leads to anaemia;

vitamin C;
important for collagen synthesis;
which is important in tissue integrity;
long-term vitamin C deficiency leads to scurvy; **[9 max]**

Option B — Electronic product design

8. (a) *Award **[1]** for stating the function of the component labelled Y in Figure B1.*

thermistor to sense change in temperature; **[1]**

(b) *Award **[1]** for identifying the function of the arrangement of components X, Y, R_1 and R_2 and **[1]** for a brief explanation **[2 max]**.*

they act as a bridge circuit/potential divider/voltage divider;
they determine the voltages of the inputs to the terminals of the operational amplifier and whether its output is high or low to drive the transistor and the alarm; **[2]**

(c) *Award **[1]** for each of three distinct correct points in an explanation of how the circuit works so that the buzzer sounds if the freezer malfunctions **[3 max]**.*

if the freezer malfunctions the temperature in the freezer will rise and the resistance of thermistor Y will decrease;
if the voltage at the inverting input (-) is lower than that that of the non-inverting (+) input;
the output of the op-amp will be high (or vice versa); **[3]**

9. (a) *Award **[1]** for a definition of converging technology to the effect of:*

the (synergistic) merging of nanotechnology, biotechnology, information and communication technologies and cognitive science; **[1]**

(b) *Award **[1]** for identifying one advantage of "The Communicator" for global cooperation and **[1]** for a brief explanation **[2 max]**.*

supports international cooperation across language and geographical barriers;
can bring together people with complementary skill sets to develop innovations; **[2]**

10. (a) *Award **[1]** for each of two distinct correct points in a description of an optical fibre **[2 max]**.*

a cable made of coated glass or plastic;
covered with a strengthening layer to prevent damage and then a thermoplastic; **[2]**

(b) *Award **[1]** for each of two distinct correct points in a description of the role of synchronization in time division multiplexing (TDM) **[2 max]**.*

TDM splits a signal into distinct time slots;
synchronization ensures the correct recombination of the time slots so the signal can be read correctly; **[2]**

11. *Award **[1]** for each distinct point in an explanation of two benefits of a manufacturer adopting a generic standard for a particular function of an electronic product **[3 max per explanation, 6 max]**.*

cost;
to develop the functionality can require enormous financial investment in R&D;
the cost of the R&D is a fixed cost which would be passed on to the consumer;

interoperability;
the product is likely to be able to integrate with other products using the generic standard;
this makes the product more competitive and gives it an advantage in the marketplace; **[6]**

12. (a) *Award **[1]** for identifying one input device applicable to a home security system and **[1]** for a brief explanation **[2 max]**.*

PIR sensors;
for motion detection;

microswitches;
for programming the system;

vibration sensors;
to detect a forced entry;

pressure pads;
to detect someone stepping on the pad;

video monitors;
to monitor movement;

light gates;
if light beam gets broken an alarm would be set off; **[2 max]**

(b) *Award **[1]** for identifying one output device applicable to a home security system and **[1]** for a brief explanation **[2 max]**.*

strobe light/siren/automatic dialing to police station;
to alert the home owner (and/or others) to a problem and deter intruders; **[2]**

(c) *Award **[1]** for identifying one ethical issue relating to the use of home security systems and **[1]** for a brief explanation **[2 max]**.*

potential loss of privacy;
there is a trade-off between privacy and security; **[2]**

13. (a) *Award **[1]** for each of three distinct correct points in an explanation of one disadvantage of upgradeability for the manufacturer **[3 max]**.*

product life is extended/planned obsolescence overcome;
consumer will not come back to purchase new product as quickly;
loss of potential new sales; **[3]**

(b) *Award **[1]** for each distinct correct point in an explanation of how digital photography can be used to minimize waste **[3 max]**.*

photos do not need to be printed;
they can be taken, shared and printed out with fewer, and less toxic, chemicals than traditional photography;
less waste paper/chemicals are produced; **[3]**

14. *Award **[1]** for each distinct correct point in a discussion of three strategies that can be used to minimize the environmental impact of electronic products on disposal **[3 max for each strategy, 9 max total]**.*

use of temporary fittings/take back legislation;
facilitate ease-of-disassembly and promote reuse and recycling;
reduce waste to landfill;

shredding;
used for small products;
does not promote reuse of components or recycling of materials;

avoiding the use of toxic substances in components/sub-assemblies;
lead, cadmium and other metals are poisonous to living organisms;
if disposed to landfill can poison soil and pollute water courses;

use of shape memory alloys for screws;
change shape on heating to critical temperature;
screws lose threads and fall out; **[9 max]**

Option C — CAD/CAM

15. (a) *Award **[1]** for stating the correct name of cutting tool A.*

round nose; **[1]**

(b) *Award **[1]** for a reason why the feed rate of a CNC lathe would be changed according to the material being processed and **[1]** for a brief explanation **[2 max]**.*

harder materials / metals require a lower feed rate than softer materials;
if you have it too high the tool will not cut properly / will become damaged; **[2]**

(c) *Award **[1]** for each of three distinct correct points in a comparison of the effects of using large or small diameter tools for CNC machining **[3 max]**.*

large diameter tools will carry out the process more quickly than small diameter tools as they cut out a larger area;
but they cannot cut intricate shapes precisely;
especially where curved surfaces are required; **[3]**

16. (a) *Award **[1]** for stating a physical property of modelling wax which makes it appropriate for use in a CNC machining process.*

(low) hardness;
easy to machine; **[1 max]**

(b) *Award **[1]** for each valid reason listed of why modelling wax is cost effective to use as a modelling material in a CNC process.*

it is easy to cut/does not wear (machine) tools;
the waste can be recycled;
it is readily available;
it can be precision engineered; **[2 max]**

17. (a) *Award **[1]** for each of two distinct correct points in a description of the relationship of the dark and light colours in the FEA image shown in Figure C1 **[2 max]**.*

the darker colours represent parts of the car unaffected by the crash/not damaged;
the lighter the colour the greater the effect of the impact on the car;

the darker colours show parts of the car unaffected by the impact;
the lighter colours show where the greatest stress concentrations have occurred; **[2 max]**

(b) *Award **[1]** for a reason why the designer would carry out a series of tests to obtain reliable data from FEA CAD images similar to that in Figure 2 and **[1]** for a brief explanation **[2 max]**.*

test the vehicle at different speeds;
based on typical speed limits for different roads;

test at different impact angles;
drivers will take different forms of evasive action in a crash;

test for impact with different objects;
to see how their properties may affect the amount of damage / stress loading;

to design better vehicles;
which are safer in a range of different scenarios; **[2 max]**

18. *Award **[1]** for each distinct point in an explanation of two ways in which the use of rapid prototyping influences the design development cycle for a new product **[3 max per way, 6 max]**.*

speed;
rapid prototyping means that sophisticated models can be produced very quickly;
so decisions can be taken about the final design more quickly than with the use of traditional modelling techniques;

cost;
although rapid prototyping can be expensive to produce;
it often eliminates the need for other types of modelling;
which reduces the overall cost of the cycle;

user trial/expert appraisal;
rapid prototype models allow potential users/experts to evaluate/test the design concept;
resulting in feedback which can be used to improve the final design; **[6 max]**

19. (a) *Award **[1]** for each of two distinct correct points in a description of one task which could be done by a robot to aid the manufacture of the spindle in Figure 3 **[2 max]**.*

sand/abrade the wood;
while it is still rotating in the lathe;

fit the wooden blank to the lathe for turning;
take the turned spindle out of the lathe;

apply a finish to the spindle;
once it has been taken out of the lathe;

provide quality control;
sensors can measure sizes/identify flaws;

prepare the blank;
depending on spindle design size;

turn the actual form of the spindle;
so increase the rate of production; **[2 max]**

(b) *Award **[1]** for each of two characteristics of the hardwood timber which are important for accurate turning of the spindles on the CNC lathe **[2 max]**.*

close grain;
no defects;
straight grain; **[2 max]**

(c) *Award **[1]** for one health and safety consideration if the spindle was manufactured from medium density fibreboard (MDF) rather than hardwood and **[1]** for a brief explanation **[2 max]**.*

fine particles of dust containing potentially harmful deposits of resin would be created from turning MDF;
the dust would need to be extracted from the atmosphere quickly; **[2]**

20. (a) *Award **[1]** for each of three distinct correct points in an explanation of how rapid prototyping can reduce the use of natural resources **[3 max]**.*

rapid prototyping methods are often additive rather than subtractive techniques;
so less material is wasted;
subtractive techniques cut the product out of a larger block of material;

there are fewer potential errors in moving from design (CAD) to manufacture (CAM) using rapid prototyping;
fewer errors result in less wasted material; **[3 max]**

(b) *Award **[1]** for each of three distinct correct points in an explanation of why multi-national corporations (MNCs) need to take out patents in different countries for a new invention **[3 max]**.*

patent laws vary from country to country;
a multi-national company will sell products in different global markets;
in order to fully protect their intellectual rights they need to register the invention with the appropriate authorities in each market if they are to successfully claim against imitators in that market; **[3]**

21. *Award **[1]** for each distinct correct point in a discussion of three reasons why car manufacturers often use animation to promote new vehicles on their website **[3 max per reason, 9 max total]**.*

animation allows the consumer to view all angles of the vehicle as it rotates;
so it gives a good overall impression of what the car looks like in reality;
and its features;

the consumer can control the speed of the animation;
so they can study a particular angle/feature;
and zoom in/out to see some features more closely;

the animation can be linked to other aspects of the website;
so the consumer can gain more detailed information from links/pull-down menus *etc*;
in order to fully evaluate the vehicle's suitability for them;

animation is more interesting for consumers than static images;
it can be used by sales people interacting with consumers in a car showroom to demonstrate features of the car;
a skilled salesperson will concentrate on the features which the consumer is particularly interested in;

raise the "sophistication" of the website;
client has a better "opinion" of the company;
increase customer satisfaction and potential sales; **[9 max]**

Do not award marks for television advertisement and/or design developments.

Option D — Textiles

22. (a) *Award **[1]** for stating one property of Spandex which makes it suitable for use in the Cedar jacket.*

Elasticity; **[1]**

(b) *Award **[1]** for one material characteristic of polyester that makes it suitable for the fleece jacket and **[1]** for a brief explanation **[2 max]**.*

good thermal conductivity;
a fleece jacket is usually worn outdoors in cold weather;

washability;
the jacket is likely to get dirty from use with outdoor activities and so needs to be easy to maintain; **[2 max]**

(c) *Award **[1]** for each of three distinct correct points in an explanation of one disadvantage of nylon for the lining of the jacket **[3 max]**.*

nylon is not breathable;
jacket will be worn outdoors and likely to be used when undertaking vigorous exercise;
moisture / sweat will be trapped making the jacket uncomfortable / creating an unpleasant odour; **[3]**

23. (a) *Award **[1]** for stating which country originally benefited from trading silk with China via the silk route.*

Italy; **[1]**

(b) *Award **[1]** for one limitation of the commercial production of spider silk ("bio steel") and **[1]** for a brief explanation **[2 max]**.*

the spiders cannot be farmed easily/cost-effectively;
they are aggressive creatures which cannot be kept together;

silk spiders are cannibalistic/they eat each other;
it is costly to provide cages for each individual spider;
a lot of spiders are needed to produce a small area of cloth (400 spiders per square yard) so bearing in mind the need to separate the spiders – too expensive to produce commercially; **[2 max]**

24. (a) *Award **[1]** for one reason why weaving is an appropriate technique to manufacture the prosthesis shown in Figure 2 and **[1]** for a brief explanation **[2 max]**.*

woven products have good dimensional stability;
so the product will not deform; **[2]**

(b) *Award **[1]** for one reason why the design of textile vascular prostheses requires a large and diverse design team and **[1]** for a brief explanation **[2 max]**.*

the technology involved is complex;
specialists from the medical profession and the textile industry are required; **[2]**

25. *Award **[1]** for each distinct point in a comparison of mass customization with craft production in relation to value-for-money for a consumer wishing to purchase a one-off item of clothing **[3 max per issue, 6 max]**.*

both processes allow for the individual requirements of the consumer in relation to fit/design;
mass customization is usually cheaper as the system provides economies of scale;
even for one-off production;

craft production will be carried out by skilled craftsmen;
who will have a wide range of skills;
such craftsmen will be able to exploit the characteristics of a specific material in order to make the most of pattern/drape;

CNC machines/CAM will carry out pre-programmed manufacturing techniques with mass customization;
craftsmen will be able to employ a variety of manufacturing techniques to create a higher-quality item;
craft production has higher labour costs compared to mass customization;
consumers who can afford to pay the high price for craft production will appreciate the quality and consider it better value-for-money; **[6 max]**

26. (a) *Award **[1]** for each of two distinct correct points in a description of how the haptic output device technology will help the gymnast to perfect her routines **[2 max]**.*

sensors measure the movement of parts of the body during the routine;
data is stored in a computer in both numerical and visual form so the gymnast has access to it when required / the textile haptic suit will be programmed to provide feedback when gymnast's routine is not perfect; **[2]**

(b) *Award **[1]** for one advantage of using laser welding in the manufacture of wearable computing garments such as the gymnasts haptic textile suit and **[1]** for a brief explanation **[2 max]**.*

neat appearance/finish to seams;
very effective / accurate joining method for seams;

as the haptic suit is skin tight, bulky sewn seams would be inappropriate and laser-welded seams would be much less bulky and more comfortable when the wearer of the garment is moving; **[2 max]**

(c) *Award **[1]** for one disadvantage of the use of laser welding for the manufacture of wearable computing garments in relation to sustainability and **[1]** for a brief explanation **[2 max]**.*

it is a permanent joining technique so garments are not as easy to repair as with stitching;
it makes garments more difficult to recycle; **[2]**

27. (a) *Award **[1]** for each of three distinct correct points in an explanation of the impact of the introduction of automation on the health of the textile industry employees **[3 max]**.*

machines are usually boxed in which contains the noise and makes it quieter for operatives;
so there is less impact on the hearing of workers than with mechanization;
and workers do not need to shout to communicate with each other;

boxing in the machines makes them safer to use;
there are likely to be fewer injuries relating to operatives coming in contact with moving parts;
extraction of dust and fibres is likely to be more effective in terms of extraction of fibre particles and reduction in atmospheric pollution;

good build quality of automated machines;
more reliability so workers do not need to constantly mend broken threads;
and better regulations mean that machines are safer to use; **[3 max]**

(b) *Award **[1]** for each of three distinct correct points in an explanation of the impact on the wider community of the introduction of mechanization in the textile industry rather than just the textile industry employees **[3 max]**.*

change from working at home in villages to working in factories in towns;
destroyed village life/communities;
and depleted craft skills;

created overcrowding in new towns;
little/poor sanitation;
disease spread quickly throughout communities;

reduced reliance on manual labour;
resulted in cheaper products;
made textile products more affordable; **[3 max]**

28. *Award **[1]** for each distinct correct point in each of three reasons why the fashion industry for clothing developed rapidly in the 20th century **[3 max per reason, 9 max total]**.*

technological improvements in manufacture;
mass production of clothing was possible which made clothing items much less expensive;
and so more affordable for ordinary people;

technological improvements in transport;
raw materials could be imported cheaply;
and finished products exported cheaply;

formation of large companies for manufacture/retailing;
economies of scale could be achieved;
creation of shops/stores in urban areas;

expansion of advertising and other media;
allowed for advertising campaigns to reach many people;
and people were influenced by fashion shown in films;

working women;
in industrialized countries many women worked in factories;
so had their own money to spend on products other than for the family;

changing social attitudes;
spending money to buy clothes to create more choice for consumers of what to wear for an occasion;
became more acceptable/desirable;

increasing relocation of factories to developing country locations;
cheaper labour/costs;
resulted in cheaper products; **[9 max]**

Option E — Human factors design

29. (a) *Award **[1]** for stating the type of data scale represented by the comfort rating scale in Figure E1.*

ordinal; **[1]**

(b) *Award **[1]** for why the responses from the user trial are qualitative and **[1]** for a brief explanation **[2 max]**.*

responses are subjective / open to interpretation / based on users' opinions;
comfort relates to a number of different factors; **[2]**

***N.B.** comfort may be affected by factors such as body size, posture, size of chair etc.*

(c) *Award **[1]** for each of three distinct correct points in an explanation of why a designer might choose to represent qualitative information from the trial quantitatively **[3 max]**.*

purely qualitative data can be difficult to analyse effectively;
it may need to be converted to a form that can be more easily analysed;
quantitative data is universally understood;
allows for patterns and trends to be determined;
data can be easily compared for different chair designs; **[3 max]**

30. (a) *Award **[1]** for stating one type of feedback used in the design of a microwave oven to alert the user that the cooking cycle is complete.*

audio/beep tone;
visual/flashing timer display; **[1 max]**

(b) *Award **[1]** for each distinct point in a description of why affordance is an important consideration in relation to the design of a product **[2 max]**.*

affordance is the property of an object which indicates how it should be used;
it lowers the memory burden / makes the user interface more intuitive; **[2]**

31. (a) *Award **[1]** for which percentiles the designer would use for the three height positions of the ironing board and **[1]** for a brief explanation **[2 max]**.*

5th, 50th and 95th adult percentiles;
to cover the majority of the users/population WTTE; **[2]**

Do not accept 5th–95th percentile or if 50th percentile is not explicitly mentioned.

(b) *Award **[1]** for one reason for providing the ironing board in three different board widths and **[1]** for a brief explanation **[2 max]**.*

types of clothes to be ironed;
some clothes will fit the board better depending on the width;

efficiency;
more fabric can be ironed on a wider board/small board will take more time to iron wide fabrics;

consumer choice;
depending on ironing techniques/styles consumers can choose the board which best suits them;

cost;
the manufacturer can differentiate the cost of the boards based on size;

reduced living/storage space;
smaller boards required; **[2 max]**

Do not accept any references to arm length.

32. *Award **[1]** for each distinct point in suggestion of each of two ways in which human factors specialists determine adequate product safety **[3 max per suggestion, 6 max]**.*

behavioural testing;
perform some activity with the product/system;
to understand the risks involved for users;

conceptual testing;
evaluate safety instructions/warning messages;
without having to expose users to potentially hazardous conditions;

fault analysis;
examination of failures;
leading to their elimination through re-design; **[6 max]**

33. (a) *Award **[1]** for which aspect of the "four pleasure framework" relates to the success of a new type of perfume and **[1]** for a brief explanation **[2 max]**.*

physio-pleasure;
the smell of the perfume stimulates demand/appeal; **[2]**

(b) *Award **[1]** for each of two distinct correct points in a description of why the purchase of a fashionable (trendy) item of clothing may promote a combination of socio-pleasure and psycho-pleasure **[2 max]**.*

Socio:
fits in with peers wearing the same type of garment;

Psycho:
promotes self-esteem/status; **[2]**

(c) *Award **[1]** for one way in which ideo-pleasure may contribute to a company's corporate social responsibility for promoting green design and **[1]** for a brief explanation **[2 max]**.*

the company will design/manufacture products which satisfy green design objectives / emphasize the green credentials when marketing the product;
to appeal to consumers who value these type of products/seek out such products to purchase; **[2 max]**

34. (a) *Award **[1]** for each of three distinct correct points in an explanation of how motion capture is used to digitally represent motion **[3 max]**.*

a person wears a set of acoustic/inertial/LED/magnetic/reflective markers at each joint;
sensors track the position of the markers as the person moves;
a digital representation of the motions is developed; **[3]**

(b) data collected is only quantitative;
does not include factors such as comfort;
does not give a complete "picture" for designers;
does not take account of "past experiences";
no feedback; **[3 max]**

35. *Award **[1]** for each distinct correct point in each of three design constraints which might compromise the user interface for a new product **[3 max per constraint, 9 max total]**.*

cost;
a designer may not have the scope to include controls/features which would make the product easier to use;
because the goal of the design brief is to design a cost-effective product which competes well in the market;

aesthetics;
the style of the product may dictate where controls/features are placed;
in order for the product to stand out/appeal in the marketplace;

inadequate user research to underpin the design;
the designer may have overlooked important aspects of the user-interface;
causing memory burden/lack of intuitiveness;

spatial considerations;
the space within which the interface must fit into the product;
this may be too small to be easy to use; **[9 max]**