



22126203

**DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 3**

Wednesday 9 May 2012 (morning)

1 hour 15 minutes

Candidate session number

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Examination code

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from one of the Options.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[40 marks]*.



0140

Option A — Food science and technology

A1. The shelf life of milk can be extended by being treated in various ways as indicated in **Table A1**. **Figure A1** shows a typical one litre pasteurized milk carton and **Figure A2** shows a collection of individual UHT milk portions.

Figure A1: Carton of pasteurized milk



Figure A2: Individual UHT milk portions



Table A1: Shelf life of milk

Untreated milk	24 hours
Pasteurized milk	5 days
Ultra-Heat treated milk (UHT) (until opened)	6–9 months
Evaporated milk (until opened)	18–24 months
Powdered (dried) milk	24–48 months

(a) State **one** reason why the pasteurization process extends the shelf life of milk. [1]

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(Question A1 continued)

- (b) Outline **one** way in which Ultra-Heat treatment (UHT) affects the organoleptic properties of milk. [2]

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- (c) Explain why powdered (dried) milk has such a long shelf life. [3]

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A2. (a) State **one** advantage of making crops resistant to the herbicide Roundup™ Ready. [1]

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(b) Outline **one** way in which consumer attitudes may impact on the development of Roundup™ Ready crops. [2]

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A3. Pot Noodle (**Figure A3**) is a commercially produced instant snack food containing a dehydrated mixture of noodles, textured soya pieces, dried vegetables and flavouring.

Figure A3: Pot Noodle instant noodle snack food



[http://commons.wikimedia.org/wiki/File:Cupnoodles_seafood_taste.jpgCreated by Wikipedia user Nightshadow28]

(a) Identify **one** reason for the increasing popularity of foods such as Pot Noodle. [2]

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(b) Describe how market testing would be used in the development of the Pot Noodle food product [2]

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A4. Compare food allergy and food intolerance in relation to impact on diet.

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A5. (a) List **two** symptoms of food poisoning. [2]

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(b) Outline **one** way in which food poisoning can be avoided. [2]

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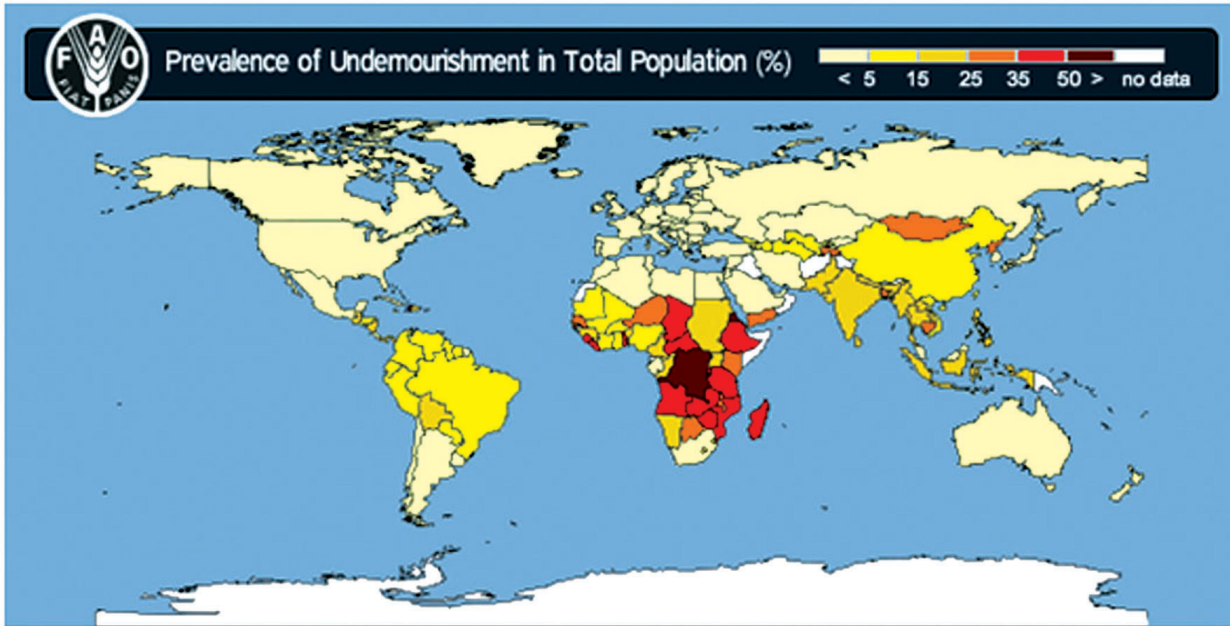
(c) Outline **one** way in which the consumption of barbequed (BBQ) food contributes to an increased incidence of food poisoning. [2]

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A6. **Figure A4** shows a map produced by the Food and Agriculture Organisation (FAO) of the prevalence of undernourishment in the total population.

Figure A4: Prevalence of undernourishment in the total population



[©Food and Agriculture Organization of the United Nations. Used with permission]

(a) Explain the geographical distribution of countries with more than 35 % undernourishment in the total population as shown by the map in **Figure A4**. [3]

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(Question A6 continued)

- (b) Explain the role of the Food and Agriculture Organization (FAO) of the United Nations (UN) in combating food insecurity. [3]

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Option B — Electronic product design

B1. **Figure B1** shows exterior solar lamps that are used in some gardens. The lamps switch on automatically when it gets dark. **Figure B2** shows the circuit for the exterior solar lamp.

Figure B1: Exterior solar lamp

Figure B2: Circuit diagram for exterior solar lamp



Content removed for copyright reasons.

[Please refer to <http://www.sentex.ca/~mec1995/gadgets/741/741.html/> and examine Figure 12 of the 741 Op-Amp Tutorial by Tony Van Roon.]

[Source: <http://en.wikipedia.org/wiki/File:Solarlight.JPG>]

(a) State the name of Component A.

[1]

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(b) Identify the purpose of Component P1 in relation to the exterior solar lamp.

[2]

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(Question B1 continued)

- (c) Explain how the operation of a comparator in the circuit in **Figure B2** influences the type of output saturation. [3]

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- B2.** (a) Define *product stewardship*. [1]

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- (b) List **two** ways in which manufacturers can meet the aims of product stewardship. [2]

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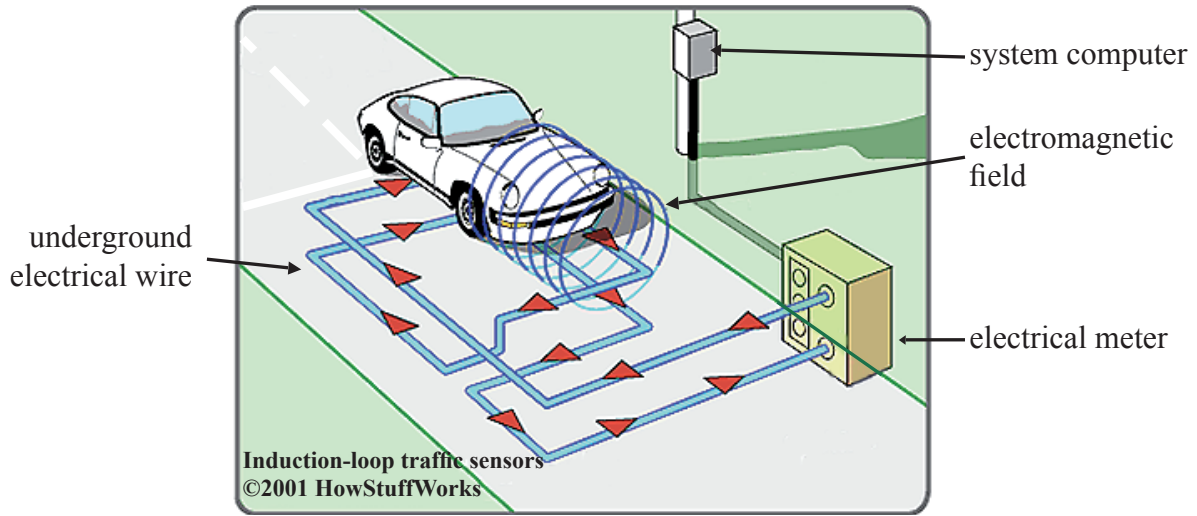
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B3. In rural or suburban environments, traffic lights often use sensors to detect the presence of traffic. **Figure B3** shows an illustration of the relationship of a vehicle to the sensor system.

Figure B3: A traffic light sensor system



[www.howstuffworks.com/enlarge-image.htm?terms=induction+loop+traffic+sensors&page=2; www.howstuffworks.com]

(a) Describe how the system shown in **Figure B3** operates. [2]

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(b) Identify **one** limitation of the use of the underground electrical wire for other road users such as cyclists. [2]

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B5. (a) Describe **one** way in which converging technology encourages planned obsolescence. [2]

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(b) List **two** ways in which converging technology can benefit national defence. [2]

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(c) Outline **one** advantage of converging technology for hearing aids. [2]

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B6. (a) Explain how the use of smart technology can conserve water use in the home. [3]

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(b) Explain how the use of smart technology to operate windows or blinds in the home can contribute to the comfort of the occupants. [3]

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B7. Discuss **three** reasons why Programmable Interface Controllers can be regarded as sustainable technology.

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Option C — CAD/CAM

C1. **Figure C1** shows a CAD image of the design of a new sign for a Design Technology department. The letters for the sign will be cut from a thermoplastic sheet using a CNC laser cutter (**Figure C2**). Laser cutting is a subtractive process. Initially, a prototype of the sign will be cut from thin card.

Figure C1: CAD image of sign



Figure C2: Laser cutter machine



http://en.wikipedia.org/wiki/File:CNC_Laser_Cutting_Machine.jpg

(a) State **one** disadvantage of using a subtractive process.

[1]

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(Question C1 continued)

- (b) Outline the settings for the CNC laser cutter that would need to be changed to produce a prototype of the sign from a thin piece of card rather than plastic. [2]

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- (c) Explain **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 for the lettering. [3]

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C2. (a) State **one** benefit of CAD for a multinational company with design teams in different parts of the world.

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(b) Outline **one** limitation of the nature of the design work if the design teams for the multi-national company never meet face-to-face.

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C3. **Figure C3** shows a chair seat made from hardwood shaped using a CNC router.

Figure C3: A chair seat made from hardwood using a CNC router



[cncrouting.co.uk. Used with permission.]

- (a) Describe the relationship between the X, Y and Z axis of the CNC router and the manufacture of the part in **Figure C3**. [2]

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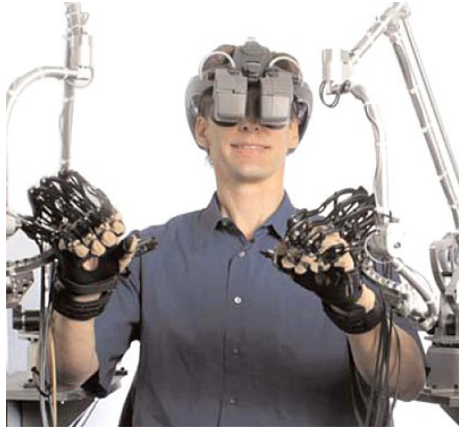
- (b) Outline **one** way in which the machine tool step variable will determine the quality of the chair seat shown in **Figure C3** when using a ball nose cutter. [2]

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C4. The Haptic Workstation shown in **Figure C4** is a 3D haptics innovation from Virtual Realities. It is a fully integrated simulation system. **Figure C5** shows a virtual reality image.

Figure C4: Haptic workstation in use



[www.vrealities.com/hapticworkstation.html;
Virtual Realities, Ltd.]

Figure C5: Virtual reality image



[Manager Mechanics virtual environment used with
permission (www.ManagerMechanics.com).]

Explain **two** differences between haptic technology and virtual reality.

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C5. (a) Identify **one** limitation when using natural timber for CAM. [2]

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(b) Outline **one** health and safety issue associated with using MDF as a modelling material in a CNC routing system. [2]

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(c) Outline **one** quality control issue associated with using metals in a CNC Milling system. [2]

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C6. Figure C6 shows a team of robots working together to weld the main frame (shell) of a vehicle.

Figure C6: Welding robots in automotive production ABB Robotics AB, Västerås, Sweden



[Source: www.abb.com/robotics]

(a) Discuss **one** advantage of using robots to weld the vehicle in **Figure C6** in relation to quality control. [3]

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(b) Discuss **one** reason why it may be cost effective for a company to replace the human workforce with robots. [3]

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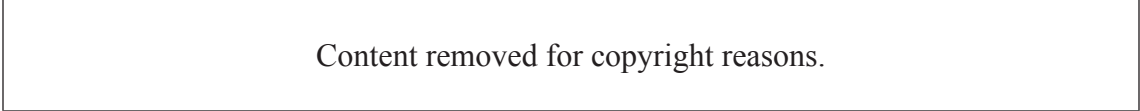
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C7. **Figure C7** shows a desk designed as a piece of flat pack furniture. It is made from medium density fibreboard (MDF) and the surface finish (veneer) is a thermosetting plastic.

Figure C7: Flat pack furniture



[Please refer to the image at <http://www.nootka.co.uk/products/washington-workbench-desk.htm>]

Discuss **three** issues in relation to the design of the flat pack furniture desk shown in **Figure C7** in relation to its manufacture with CNC machinery.

[9]

A large rectangular area containing horizontal dotted lines for writing.



Option D — Textiles

D1. **Figure D1** and **Figure D2** show two types of acousto-magnetic security tags used by clothes retailers. They are made from two parts, a block and a pin, which are joined magnetically and can only be removed using a magnetic detacher device. The Supertag (**Figure D1**) is 55 mm long. The Unisen Duraltag (**Figure D2**) is 25 mm in diameter.

Figure D1: Supertag



Figure D2: Unisen Duraltag

Content removed for copyright reasons.

[http://www.sentecheas.com/products_cat.asp?disp=detail&id=STC1100-2 Image of SenTech UltraTag®, used with permission from SenTech]

[Please refer to the Duraltag® image at <http://www.unisen.com/New-Security-Products.html>]

- (a) State **one** reason why retailers might choose to use the Supertag (**Figure D1**) rather than the Unisen Duraltag (**Figure D2**). [1]

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- (b) Outline **one** reason why the tagging systems shown in **Figure D1** and **Figure D2** are only suitable for a limited range of soft goods. [2]

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(Question D1 continued)

- (c) Explain **one** reason why tagging systems as shown in **Figure D1** and **Figure D2** are more popular with large retail outlets such as department stores than small shops. [3]

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- D2.** (a) State **one** limitation of the disposal of synthetic textiles into landfill sites. [1]

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- (b) Outline **one** advantage of *reuse* rather than *recycle* in relation to cotton products. [2]

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D3. The fabric shown in **Figure D3** has a decorative image woven into it. The fabric has been designed using a CAD program which can convert image files into weave patterns.

Figure D3: Jacquard fabric



[Source: http://commons.wikimedia.org/wiki/File:V%C3%A4v_Daldr%C3%A4ll.jpg]

(a) Outline **one** advantage for the client of using CAD to design the fabric in **Figure D3**. [2]

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(b) Outline **one** issue that the designer must consider when designing the fabric in **Figure D3** for production using CAM. [2]

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D4. Carpets can be treated with a chemical finish to help prevent permanent stains if liquids are spilled (**Figure D4**). This carpet has been treated with chemicals after the carpet has been fitted in the home rather than during manufacture.

Figure D4: Coffee stained carpet



[www.brightoncarpetcleaning.co.uk/Stain-removal-tips.html; Brighton Carpet Cleaning.]

Discuss **two** disadvantages of this method of producing stain resistant carpets.

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D5. (a) Describe **one** way in which wearable computing can be used to monitor medical conditions. [2]

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(b) List **two** considerations for the designer of wearable computing garments. [2]

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(c) Outline the relationship between value and the consumer in relation to purchasing wearable computing garments. [2]

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D6. (a) Explain **one** environmental impact of growing cotton.

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(b) Explain **one** issue in relation to clean technology for the cotton dyeing process.

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D7.

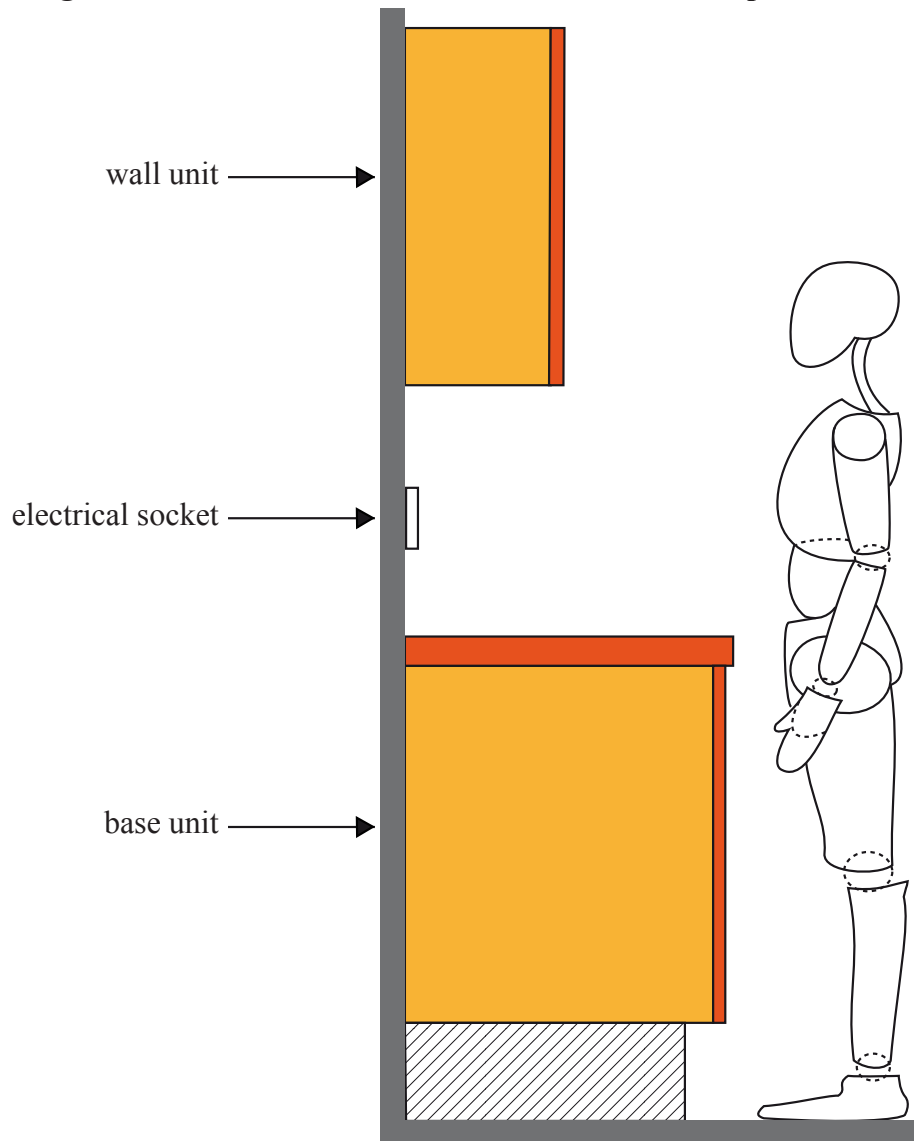
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Option E — Human factors design

E1. Figure E1 shows a side view of a standard kitchen unit and an anthropometric model.

Figure E1: Side view of a kitchen unit and an anthropometric model



(a) State the adult percentile which would be used to decide the height of the wall unit. [1]

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(Question E1 continued)

- (b) List **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]

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- (c) Discuss how the user would make best use of the kitchen units for storage in terms of efficiency and safety. [3]

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E2. Figure E2 shows taps produced by the company Cupree for the disabled market sector.

Figure E2: Cupree taps



[Source: www.cupree.com]

(a) State **one** visual aspect of the design which has been employed to assist the user. [1]

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(b) Outline **one** way in which the design of the taps assist users with limited hand movement. [2]

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E3. Figure E3 shows a storage unit for a computer printer used as part of the integrated home office shown in Figure E4.

Figure E3: Printer storage unit



Figure E4: Prima Integrated Home Office



[Strachan Furniture Makers Ltd. Used with permission.]

(a) Describe how the designer has combined ease-of-use with aesthetics for the printer storage unit in **Figure E3**. [2]

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(b) Outline **one** limitation of using the storage unit in relation to bodily tolerance. [2]

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E4. **Figure E5** and **Figure E6** show a right-handed version of the Maltron single-handed keyboard. The shape of the keyboard matches natural hand movements. The letter layout minimizes finger movements.

Figure E5: Maltron keyboard

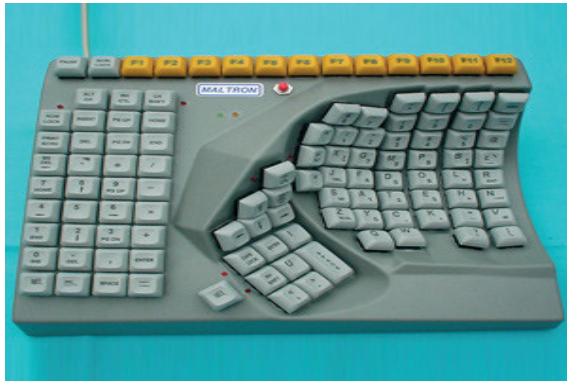


Figure E6: Maltron keyboard in use



[Published with kind permission from PCD Maltron Ltd, Stafford, England.]

Discuss **two** user considerations for the adoption of the Maltron keyboard as a mass market product.

[6]

A large rectangular box containing horizontal dotted lines for writing the answer to the question.



E5. (a) Outline which aspect of the *four pleasure framework* is experienced by an employee wearing a uniform. [2]

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(b) Describe **one** way in which the design of a mobile phone may promote psycho-pleasure. [2]

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(c) Describe the relationship between ideo-pleasure and being an eco-fan. [2]

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E6. (a) Explain how motion capture can assist designers in the development of clothing for competitive skiers. [3]

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(b) Explain how motion capture can contribute to the cost-effectiveness of product development. [3]

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