



22146203

**DESIGN TECHNOLOGY  
HIGHER LEVEL  
PAPER 3**

Candidate session number

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Tuesday 20 May 2014 (morning)

Examination code

1 hour 15 minutes

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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].

Option	Questions
Option A — Food science and technology	1–7
Option B — Electronic product design	8–14
Option C — CAD/CAM	15–21
Option D — Textiles	22–28
Option E — Human factors design	29–35



44EP01

Option A — Food science and technology

- 1. Governments often provide advice on how to achieve healthier lifestyles. One current piece of UK government advice is that people should eat more fruit and vegetables.

Figure A1 shows the home page of a 5 A DAY online shopping list and menu planner from which consumers can access free advice. It also contains additional resources, such as recipes based on seasonal produce, and information about fruit and vegetables.

Figure A1: The 5 A DAY shopping list and menu planner



[Source: <http://www.nhs.uk/livewell/5aday/pages/portionsizes.aspx>.  
Contains public sector information licensed under the Open Government Licence v2.0.]

- (a) State **one** health benefit of the 5 A DAY shopping list and menu planner for families with young children. [1]

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(Option A continues on the following page)



44EP02

*(Option A, question 1 continued)*

- (b) List **two** nutritional benefits of eating more fruit and vegetables. [2]

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- (c) Explain **one** reason why some governments provide public health advice and tools, such as the 5 A DAY shopping list and menu planner. [3]

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*(Option A continues on the following page)*



44EP03

Turn over

*(Option A continued)*

2. (a) Define *undernourishment*. [1]

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- (b) Outline **one** reason why local strategies are critically important for food security. [2]

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*(Option A continues on the following page)*



44EP04

(Option A continued)

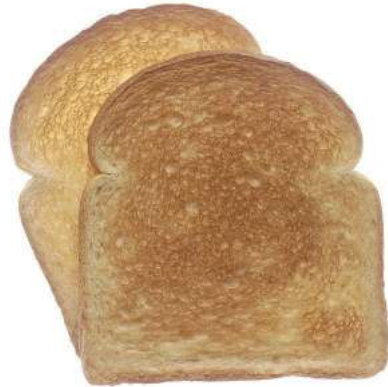
- 3. Browning of food occurs for different reasons. **Figure A2** shows bananas that have browned over time. **Figure A3** shows slices of bread that have been browned by toasting.

**Figure A2: Browned banana**



[Source: [http://commons.wikimedia.org/wiki/File:Barangan\\_banana\\_Indonesia.JPG](http://commons.wikimedia.org/wiki/File:Barangan_banana_Indonesia.JPG); author Midori]

**Figure A3: Toasted bread**



[Source: <http://commons.wikimedia.org/wiki/Toast#mediaviewer/File:ToastedWhiteBread.jpg>]

- (a) Describe how a banana browns over time.

[2]

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- (b) Describe how the browning of the toasted bread occurs.

[2]

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(Option A continues on the following page)



44EP05

Turn over

*(Option A continued)*

4. Explain **two** ways in which the packaging of food products contributes to the development of brands.

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*(Option A continues on the following page)*



44EP06

*(Option A continued)*

5. European Union (EU) legislation requires genetically modified food to be labelled whereas legislation in the United States (US) does not.

(a) Outline **one** implication for European food manufacturers associated with the lack of a labelling requirement for US foods when purchasing ingredients from the US. [2]

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(b) Outline **one** implication of not labelling genetically modified foods for US consumers. [2]

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(c) Outline **one** ethical benefit of genetic modification of foods for consumers. [2]

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*(Option A continues on the following page)*



44EP07

Turn over

*(Option A continued)*

6. (a) Explain **one** way in which food contamination can be minimized in a self-service restaurant. [3]

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- (b) Explain **one** issue relating to the storage of food on the counter of a self-service restaurant over a two-hour period. [3]

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*(Option A continues on the following page)*



44EP08

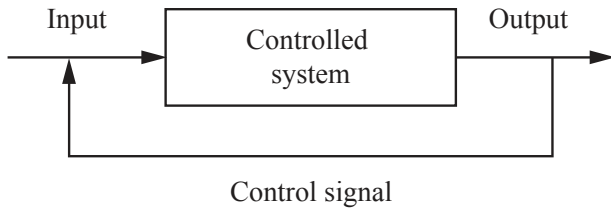




**Option B — Electronic product design**

8. **Figure B1** shows a closed loop control system which can be used in a range of design contexts, for example, a climate control / air conditioning unit in a car. **Figure B2** shows the control panel for a climate control unit.

**Figure B1: Closed loop control system**



[Source: © International Baccalaureate Organization 2014]

**Figure B2: The control panel for a climate control unit**



[Source: www.preh.com ]

(a) State **one** piece of input data that is needed for the climate control unit to control the air temperature in a car. [1]

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(b) Outline **one** other variable that will impact on the effectiveness of the closed loop control system. [2]

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*(Option B continues on the following page)*



44EP10

(Option B, question 8 continued)

- (c) Explain why the closed loop control system for a car uses negative feedback. [3]

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9. (a) Define *virtual reality*. [1]

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- (b) Outline **one** design consideration in the development of a wearable human-computer interface for the implementation of virtual reality. [2]

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(Option B continues on the following page)



*(Option B continued)*

10. **Figure B3** shows a screen shot of iTunes® – a generic digital music system.

**Figure B3: iTunes®**

Image removed due to copyright reasons  
[Source: <http://www.apple.com/itunes/>]

(a) Outline **one** advantage for a consumer using a generic digital music system, such as iTunes®.

[2]

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*(Option B continues on the following page)*



44EP12

*(Option B, question 10 continued)*

- (b) Outline **one** advantage for a manufacturer of developing its own digital music system. [2]

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- 11. Explain **two** reasons why many electronic products are designed to operate at dual voltages, for example, US 120 V UK 240 V. [6]

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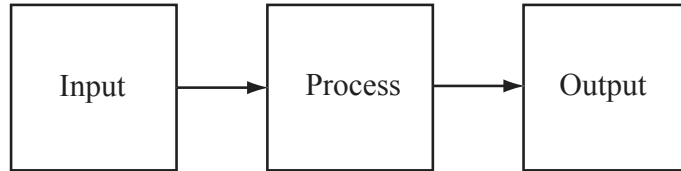
44EP13

Turn over

(Option B continued)

- 12. A do-it-yourself hobbyist is designing an automated blind system to open a window blind in the morning and close it in the evening. The system is represented using a block diagram (Figure B4).

Figure B4: A block diagram of the automated blind system

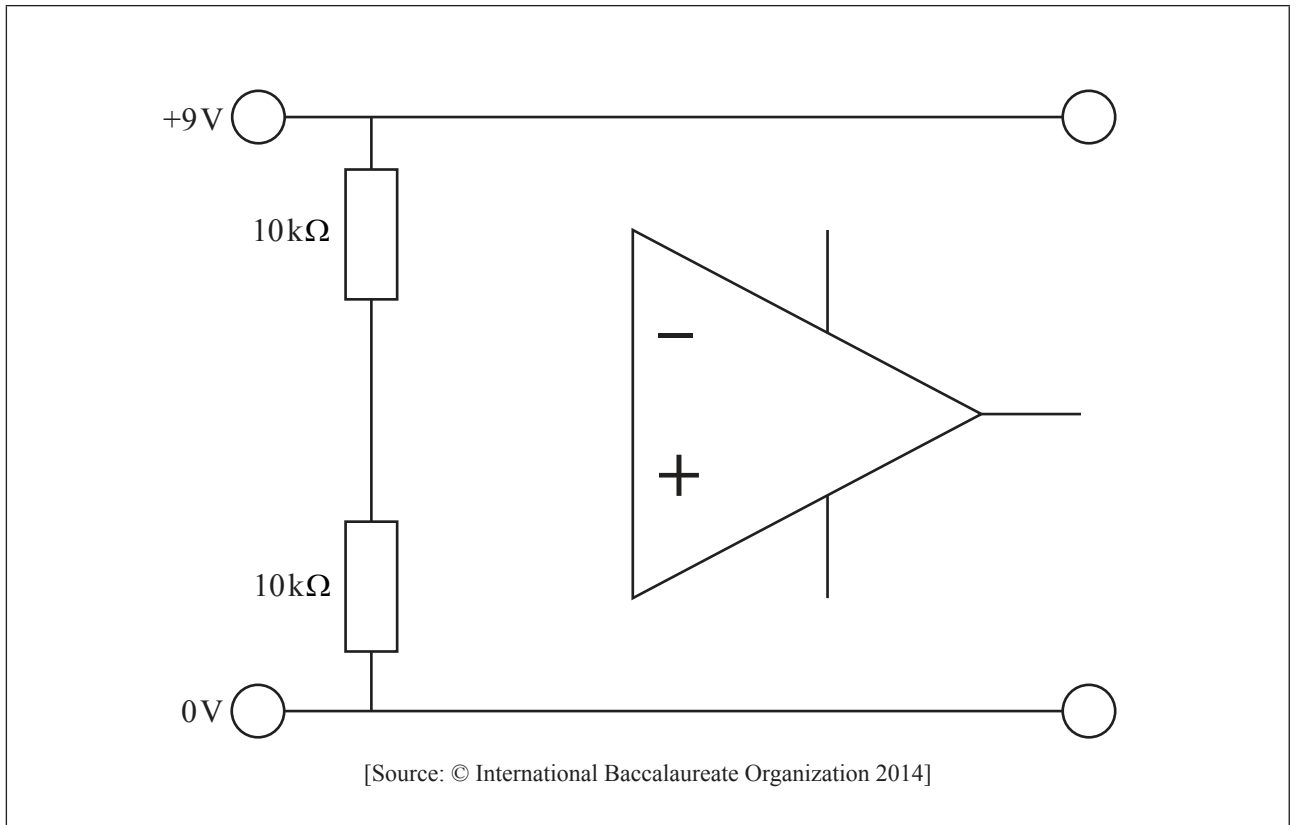


[Source: © International Baccalaureate Organization 2014]

- (a) Annotate Figure B5 to show how a light dependent resistor (LDR) would contribute to the light sensor circuit inputting to the programmable interface controller (PIC) in the implementation of the automated blind system so that it can be adjusted to determine the light level at which the blind opens or closes.

[2]

Figure B5: Incomplete light sensor circuit



[Source: © International Baccalaureate Organization 2014]

(Option B continues on the following page)



44EP14

*(Option B, question 12 continued)*

- (b) List **two** characteristics of PICs that make them suitable for implementing the automated blind system. [2]

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- (c) Describe a suitable output device for the automated blind system. [2]

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*(Option B continues on the following page)*



44EP15

**Turn over**

*(Option B continued)*

13. (a) Explain **one** advantage of upgradeability of electronic products for consumers. [3]

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(b) Explain **one** way in which the design of electronic products has contributed to the increased pace of innovation. [3]

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*(Option B continues on the following page)*



44EP16

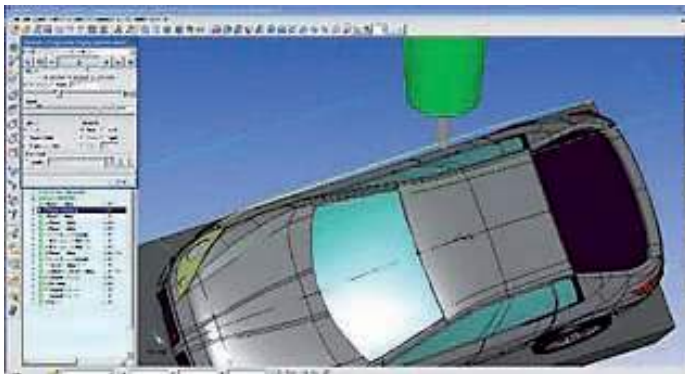




**Option C — CAD/CAM**

15. A toy company produced a number of physical models during the design development of its new toy car collection. **Figure C1** shows a CAD simulation of the production of a toy car. **Figure C2** shows a scale model of a toy car being machined from a block of metal on a five-axis computer numerical control (CNC) machine.

**Figure C1: CAD simulation of a toy car**



[Source: © Vero Software. Used with permission]

**Figure C2: Scale model of a toy car**



[Source: © Vero Software. Used with permission]

- (a) State **one** reason for using different feed speeds during the production of the scale model in **Figure C2**. [1]

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- (b) Outline **one** advantage of using a five-axis CNC machine to produce the scale model in **Figure C2**. [2]

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*(Option C continues on the following page)*



44EP18

*(Option C, question 15 continued)*

- (c) Explain **one** benefit of creating the CAD simulation in **Figure C1** for the production of the scale model in **Figure C2**. [3]

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- 16. (a) State **one** characteristic of modelling wax that makes it suitable for use with CAM. [1]

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- (b) Outline **one** way in which modelling wax is used with CAM to produce jewellery. [2]

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*(Option C continues on the following page)*



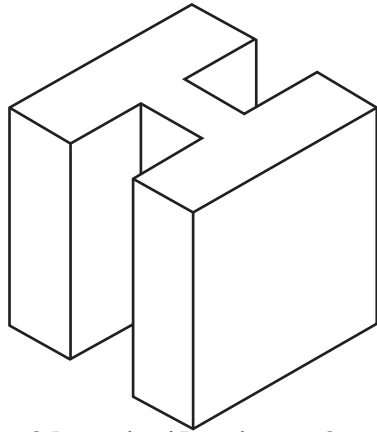
44EP19

Turn over

(Option C continued)

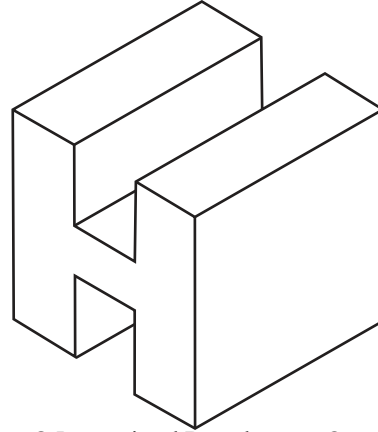
17. In rapid prototyping, 3D models are sliced into a number of 2D shapes. For optimal results, different orientations are considered. **Figure C3** and **Figure C4** show two different orientations for the same 3D model.

**Figure C3: Orientation A**



[Source: © International Baccalaureate Organization 2014]

**Figure C4: Orientation B**



[Source: © International Baccalaureate Organization 2014]

- (a) Outline **one** advantage of using orientation A (**Figure C3**) with solid object printing. [2]

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- (b) Outline why either orientation A (**Figure C3**) or orientation B (**Figure C4**) is suitable for use with select laser sintering (SLS). [2]

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(Option C continues on the following page)



44EP20



*(Option C continued)*

19. (a) Outline **one** implication of the increased use of CAD on the infringement of copyright. [2]

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(b) Outline **one** impact of the use of CAM on the infringement of patents. [2]

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(c) Outline **one** reason why some companies decide not to protect their innovative products with patents. [2]

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*(Option C continues on the following page)*



*(Option C continued)*

20. (a) Explain **one** reason why traditional craft production techniques are still used in the manufacture of some cars. [3]

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- (b) Explain **one** social disadvantage, other than unemployment, associated with replacing traditional manufacturing techniques with robots. [3]

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*(Option C continues on the following page)*



44EP23

Turn over





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44EP25

Turn over

**Option D — Textiles**

- 22. Figure D1** shows the Nike® Flyknit shoe. The design brief was to produce a structurally supportive, lightweight, tight-fitting athletic shoe. It is made using polyester yarn with variable elasticity, durability, thickness, and strength. The Nike Flyknit shoe was designed for use by long-distance runners and was introduced to competition at the London 2012 Olympics.

**Figure D1: The Nike® Flyknit shoe**

Image removed due to copyright reasons  
[Source: adapted from [www.freshnessmag.com](http://www.freshnessmag.com) and [www.nike.com](http://www.nike.com)]

*(Option D continues on the following page)*



44EP26

*(Option D, question 22 continued)*

- (a) State **one** characteristic relating to ease of maintenance that makes polyester suitable for the Nike Flyknit shoe. [1]

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- (b) Outline **one** characteristic of knitted fabrics that contributes to the tight fit of the finished Nike Flyknit shoe. [2]

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- (c) Explain the advantage to Nike of launching the Flyknit shoe at the London 2012 Olympics. [3]

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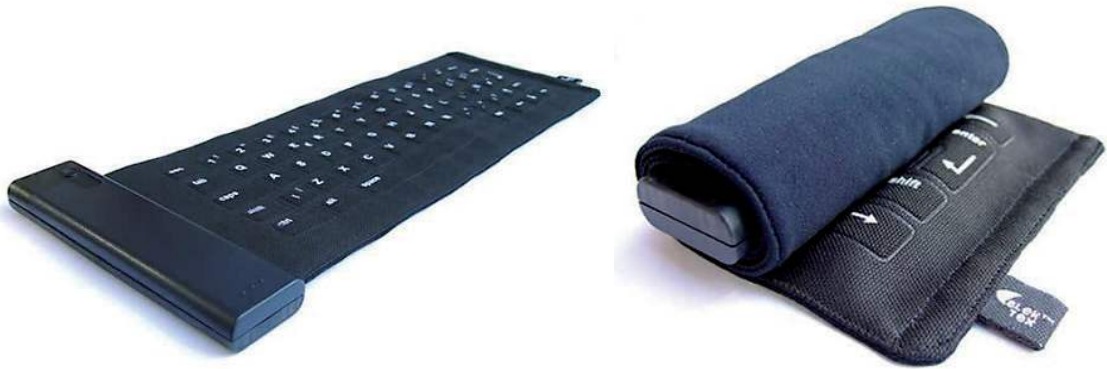
44EP27

**Turn over**

(Option D continued)

23. Figure D2 shows the Elektex<sup>®</sup> fabric keyboard.

Figure D2: The Elektex<sup>®</sup> fabric keyboard



[Source: www.gizmag.com]

(a) Define *intelligent fabric*.

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(b) Describe how Elektex fabric would contribute to the performance of the fabric keyboard shown in **Figure D2**.

[2]

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(Option D continues on the following page)



44EP28

(Option D continued)

24. Figure D3 shows burrs which were the design inspiration of Velcro® (Figure D4).

Figure D3: Burrs



[Source: [http://commons.wikimedia.org/wiki/File:Bur\\_Macro\\_BlackBg.jpg](http://commons.wikimedia.org/wiki/File:Bur_Macro_BlackBg.jpg)]

Figure D4: Velcro®



[Source: [http://commons.wikimedia.org/wiki/File:Micrograph\\_of\\_hook\\_and\\_loop\\_fastener,\(Velcro\\_like\).jpg](http://commons.wikimedia.org/wiki/File:Micrograph_of_hook_and_loop_fastener,(Velcro_like).jpg); Natural Philo]

(a) Outline **one** reason why Velcro is an example of biomimetics.

[2]

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(b) Outline **one** reason why nylon is suitable for the production of Velcro.

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(Option D continues on the following page)



44EP29

Turn over

*(Option D continued)*

25. Explain **two** considerations in relation to the biocompatibility of textile vascular prostheses. [6]

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*(Option D continues on the following page)*



*(Option D continued)*

26. Organically-grown cotton addresses many of the environmental issues associated with the cultivation of cotton. The Global Organic Textile Standard (GOTS) defines a range of environmental and social criteria for organic textiles.

(a) Outline **one** environmental issue associated with the cultivation of non-organic cotton. [2]

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(b) Outline **one** benefit of the “EU Flower” system for consumers. [2]

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(c) Outline **one** advantage of the Global Organic Textile Standard rather than the “EU Flower” system for textile producers. [2]

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*(Option D continues on the following page)*



44EP31

Turn over

*(Option D continued)*

27. (a) Discuss **one** issue in relation to human resource management for a large multinational company establishing a textile manufacturing plant in a developing country. [3]

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- (b) Discuss **one** disadvantage for a developing country of a large multinational company establishing a textile manufacturing plant there. [3]

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*(Option D continues on the following page)*



44EP32





**Option E — Human factors design**

29. **Figure E1** shows a remote control handset used for use with a television set connected to a satellite receiver.

**Figure E1: Remote control handset**



[Source: Image courtesy of suphakit73/FreeDigitalPhotos.net.]

- (a) State **one** reason why the control buttons on the handset are not all the same size. [1]

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*(Option E continues on the following page)*



*(Option E, question 29 continued)*

- (b) Outline **one** reason for the shape (profile) of the handset in **Figure E1**. [2]

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- (c) Explain **one** reason for using a colour scheme for the buttons on the handset shown in **Figure E1**. [3]

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*(Option E continues on the following page)*



44EP35

Turn over

*(Option E continued)*

30. (a) State which aspect of the “four pleasure framework” is triggered by the aroma of freshly-baked bread. [1]

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- (b) Outline **one** reason why technophiles would experience psycho-pleasure when using a newly-purchased mobile phone. [2]

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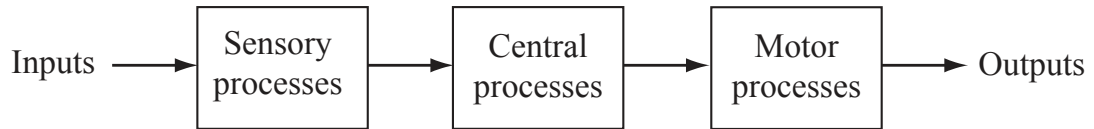
*(Option E continues on the following page)*



(Option E continued)

31. **Figure E2** shows a flow diagram identifying the stages in a human information-processing system. The flow diagram can be applied to the context of receiving and responding to a text message on a mobile phone.

**Figure E2: Human information-processing system flow diagram**



[Source: © International Baccalaureate Organization 2014]

(a) Describe the function of the sensory input when receiving a text message on a mobile phone. [2]

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(b) Outline **one** reason why the motor processing stage may lead to errors in writing a response to the received message. [2]

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(Option E continues on the following page)



44EP37

Turn over

*(Option E continued)*

**32.** Suggest **two** reasons why dimensions in anthropometric data tables are stated as estimates. [6]

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*(Option E continues on the following page)*



*(Option E continued)*

33. (a) Outline **one** way in which designers have improved the opportunities for disabled people to participate fully in sports activities. [2]

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- (b) Outline **one** method that designers could use to research human factors for the design of a wheelchair to be used by disabled athletes. [2]

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- (c) Outline **one** way in which the use of digital humans would increase the speed of the product development process for the new wheelchair design. [2]

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*(Option E continues on the following page)*



44EP39

Turn over

*(Option E continued)*

34. (a) Discuss **one** way in which cultural differences can impact on a person’s attitude to personal space when using an airport lounge. [3]

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- (b) Explain **one** way in which designers take into account different attitudes to personal space in the layout of the furniture in a café. [3]

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*(Option E continues on the following page)*



44EP40





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44EP44