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DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 3

Candidate session number

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Tuesday 19 November 2013 (morning)

1 hour 15 minutes

Examination code

8	8	1	3	–	6	2	0	3

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
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44EP01

Option A — Food science and technology

1. **Figure A1** shows the new guidance offered to consumers for freezing fresh food. Previous guidance was to freeze food on the day of purchase only. It is estimated that the new labelling advice could stop enormous amounts of food being wasted each year.

Figure A1: New labelling guidance relating to the freezing of food

If you are going to freeze food, it has to be frozen before the use by date and then freeze for up to one month and use immediately

[Source: Image: http://en.wikipedia.org/wiki/File:Snow_flake.svg.
Text: http://www.j-sainsbury.co.uk/media/445015/freezing_guidelines_on_pack_520.jpg.]

(a) State **one** reason for freezing food apart from reducing waste. *[1]*

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(b) Outline **one** reason why it is recommended that when frozen food is defrosted it should be used on the same day. *[2]*

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(Option A continues on the following page)

(Option A, question 1 continued)

(c) Explain **one** benefit of the new labelling advice apart from stopping enormous amounts of food being wasted each year. *[3]*

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2. (a) Define *food security.* *[1]*

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(b) Outline **one** way in which a government could assess if there is food security in its country. *[2]*

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(Option A continues on the following page)

(Option A continued)

3. **Figure A2** shows a bottle of Powerade – a sports drink designed for use after intense exercise. It is produced by the Coca-Cola® company. Powerade mainly comprises sugar and water with minerals (sodium and potassium) and B vitamins.

Figure A2: Powerade sports drink

Figure A2 removed for copyright reasons

(a) Describe the importance of B vitamins for athletes. *[2]*

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(b) Describe why the minerals sodium and potassium are important for athletes. *[2]*

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(Option A continues on the following page)

(Option A continued)

4. Explain **two** types of food spoilage. *[6]*

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(Option A continues on the following page)

(Option A continued)

5. Food hygiene rating schemes (**Figure A3**) – sometimes called the scores on the doors – publish data which helps protect consumers from the risk of food poisoning when eating out. Food safety officers check how food outlets prepare, cook, re-heat, cool and store foods. They also check the layout and condition of food preparation areas.

Figure A3: Food hygiene ratings

[Source: © Crown copyright. Public Health England in association with the Welsh Government, the Scottish Government and the Food Standards Agency in Northern Ireland.]

(a) Outline **one** way in which food hygiene rating schemes help reduce the risk of food poisoning when eating out. *[2]*

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(b) Outline **one** reason why food safety officers check that food is properly cooked and stored before serving. *[2]*

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(Option A continues on the following page)

(Option A, question 5 continued)

(c) Outline **one** reason food safety officers check the layout of a food preparation area in a food outlet. *[2]*

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6. (a) Explain how technology push has enabled the production of genetically modified organisms (GMOs). *[3]*

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(b) Explain **one** implication of low market pull for genetically modified foods, such as the Flavr Savr™ tomato. *[3]*

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(Option A continues on the following page)

(Option A continued)

7. Explain **three** ways in which on-farm processing can enhance the sustainability of the rural economy. *[9]*

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End of Option A

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Option B — Electronic product design

8. **Figure B1** shows a quad logic chip with four identical digital logic gates.

Figure B1: Chip with four identical digital logic gates

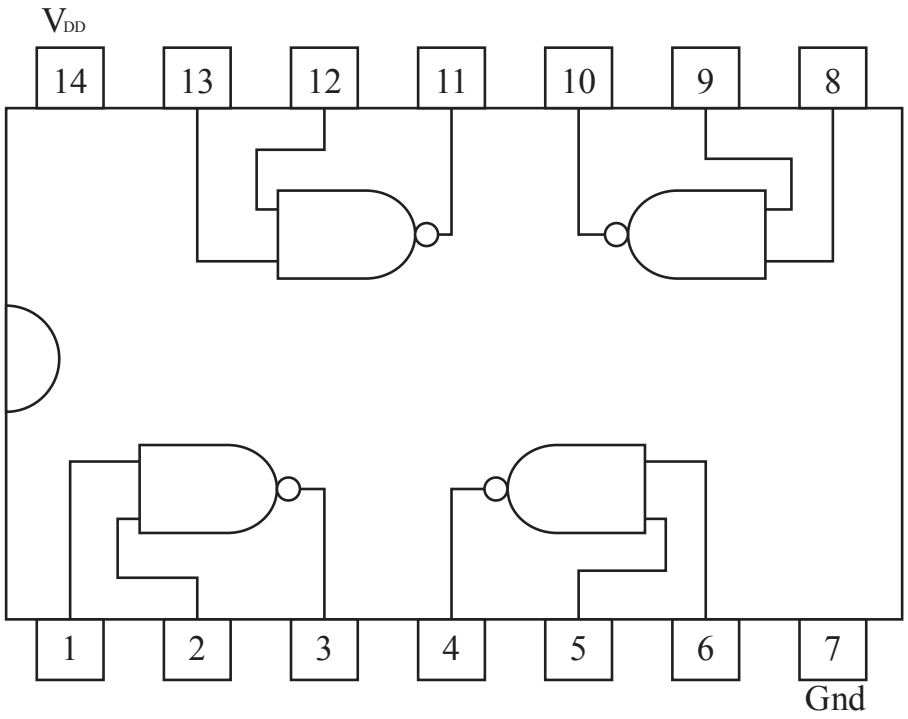
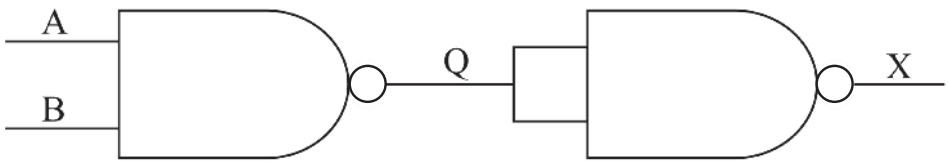


Figure B2: Logic circuit comprising two digital logic gates on the chip shown in Figure B1



(Option B continues on the following page)

(Option B, question 8 continued)

(a) State the type of digital logic gate on the chip shown in **Figure B1**. *[1]*

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(b) Construct the truth table shown below for the circuit in **Figure B2**. *[2]*

A	B	Q	X
0	0		
0	1		
1	0		
1	1		

(c) Explain **one** reason why a manufacturer might decide to use the quad logic chip shown in **Figure B1** in circuit design. *[3]*

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(Option B continues on the following page)

(Option B continued)

9. (a) State **one** implication of the increasing file size of digital photographs. *[1]*

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(b) Outline **one** benefit of converging technology for the use of digital photographs. *[2]*

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(Option B continues on the following page)

(Option B continued)

10. **Figure B3** shows a voltage divider. It comprises two resistors R_1 and R_2. R_2 is marked with brown, green, orange and gold bands.

Figure B3: Voltage divider

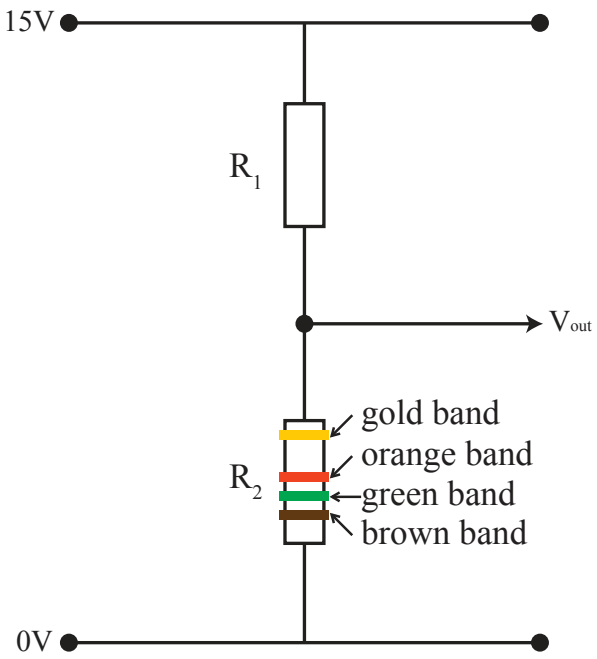

Table B1: Resistor colour coding

Color	Value
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9
Gold	± 5%

(a) Calculate the range within which the resistance of R_2 lies. *[2]*

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(b) Calculate the ratio of R_1 to R_2 to achieve an output voltage of 10 volts. *[2]*

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(Option B continues on the following page)

(Option B continued)

11. Explain **two** criteria for an appropriate solution for the supply of electricity to communities in remote areas of developing countries. *[6]*

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(Option B continues on the following page)

(Option B continued)

12. (a) Identify **one** input device and **one** output device which might be used in a home security system. *[2]*

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(b) Outline the importance of refresh rates in a video-monitored home security system. *[2]*

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(c) Describe **one** ethical issue relating to home security systems. *[2]*

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(Option B continues on the following page)

(Option B continued)

13. (a) Explain **one** benefit of design for dematerialization for consumers. *[3]*

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(b) Explain **one** advantage of electronic products that incorporate upgradeability for consumers. *[3]*

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(Option B continues on the following page)

(Option B continued)

14. Discuss **three** considerations for installing a copper wire network in comparison to a fibre optic network. *[9]*

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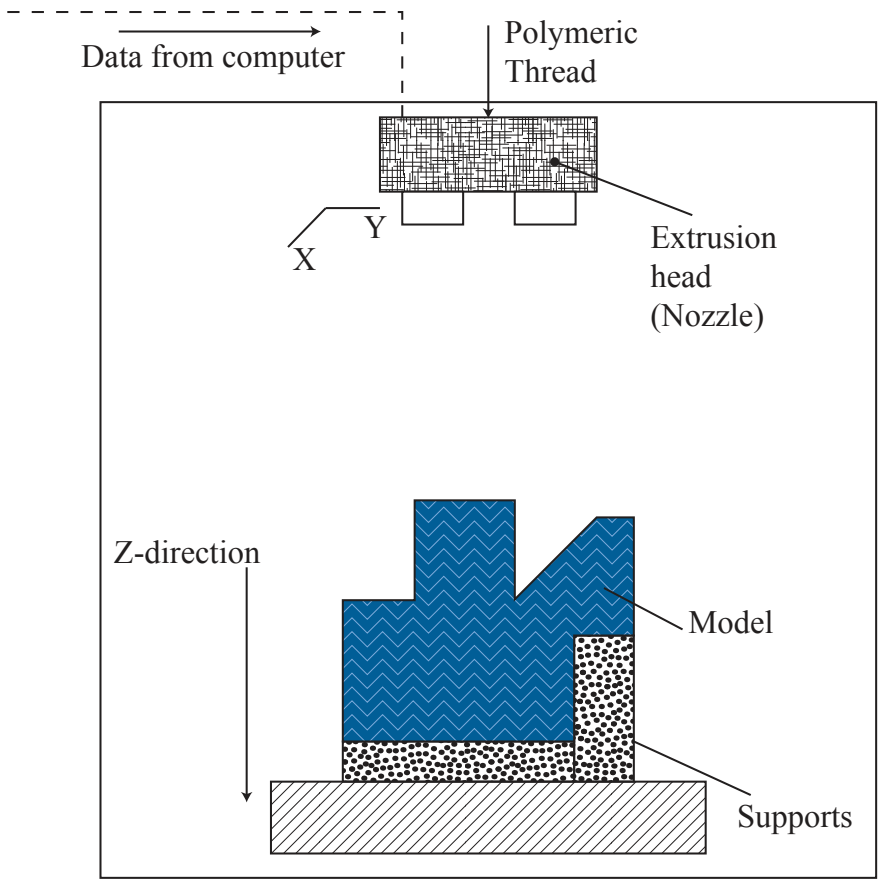
End of Option B

Option C — CAD/CAM

15. **Figure C1** shows a schematic 2D diagram of fuse deposition modelling (FDM) rapid prototype manufacture.

Figure C1: Schematic 2D diagram of the FDM process



[Source: © International Baccalaureate Organization 2014]

(a) State **one** advantage to the designer of using FDM rapid prototype manufacturing technology. *[1]*

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(Option C continues on the following page)

(Option C, question 15 continued)

(b) Describe the function of the extrusion head in the FDM process shown in **Figure C1**. *[2]*

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(c) Explain **one** reason why support material is required when using FDM rapid prototype manufacture as shown in **Figure C1**. *[3]*

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(Option C continues on the following page)

(Option C continued)

16. (a) State **one** advantage of replacing hydraulic robots with electrical robots in a manufacturing environment. *[1]*

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(b) Outline **one** way in which feedback aids development of artificial intelligence in some robots. *[2]*

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(Option C continues on the following page)

(Option C continued)

17. (a) Outline **one** advantage of a computer-integrated manufacturing (CIM) system for consumers. *[2]*

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(b) Outline **one** disadvantage of adopting a CIM system for a small manufacturing company. *[2]*

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(Option C continues on the following page)

(Option C continued)

18. **Figure C2** shows a video snapshot of a virtual walk-through of the apartment.

Figure C2: Video snapshot of a virtual walk-through of an apartment

Figure C2 removed for copyright reasons

Explain **two** advantages to the consumer of using virtual reality software in designing new buildings. *[6]*

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(Option C continues on the following page)

(Option C continued)

19. (a) Outline **one** social impact on designers of the increasing use of CAD. *[2]*

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(b) Outline **one** implication of the use of CAD for training of designers in a large multinational company. *[2]*

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(c) Outline **one** reason why the use of CAM may lead to increased use of natural resources. *[2]*

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(Option C continues on the following page)

(Option C continued)

20. (a) Explain **one** reason why some products continue to be produced by traditional manufacturing techniques even though they could be produced by CAM. *[3]*

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(b) Explain **one** way in which CAD allows for flexible manufacture. *[3]*

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(Option C continues on the following page)

(Option C continued)

21. Explain **three** ways in which CAD/CAM has impacted on the market for furniture from a consumer perspective. *[9]*

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End of Option C

Option D — Textiles

22. The red line on the map in **Figure D1** shows the original route of the "Silk Road" from 100 BCE.

Figure D1: Map showing the original route of the "Silk Road" as a red line

Figure D1 removed for copyright reasons

(a) State **one** reason why the Chinese had a monopoly of silk production for about 3000 years. *[1]*

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(Option D continues on the following page)

(Option D, question 22 continued)

(b) Outline **one** way in which the "Silk Road" could be considered the information superhighway of its day. *[2]*

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(c) Explain **one** reason for the continued popularity of silk for clothing. *[3]*

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(Option D continues on the following page)

(Option D continued)

23. (a) State **one** benefit for a textile company of adopting the "EU Flower". *[1]*

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(b) Outline **one** disadvantage of adopting the "EU Flower" for manufacturers who produce products using several different raw materials. *[2]*

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(Option D continues on the following page)

(Option D continued)

24. **Figure D2** shows a hat that is made from 100 % Alpaca wool. It is knitted by hand in Peru and is sold online via the Internet for US$45.99.

Figure D2: A hat made from Alpaca wool

[Source: www.peruhandicraft.com. Used with permission.]

(a) Outline **one** reason why the hat is made by hand. *[2]*

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(b) Outline **one** way that the design of the hat could be modified to reduce the cost of manufacture. *[2]*

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(Option D continues on the following page)

(Option D continued)

25. **Figure D3** shows two cyclists wearing garments made from Lycra®.

Figure D3: Cyclists wearing Lycra® apparel

[Source: http://en.wikipedia.org/wiki/File:Barney_Storey_and_Neil_Fachie.jpg]

Explain **two** ways in which Lycra® has contributed to the enhanced performance of racing cyclists. *[6]*

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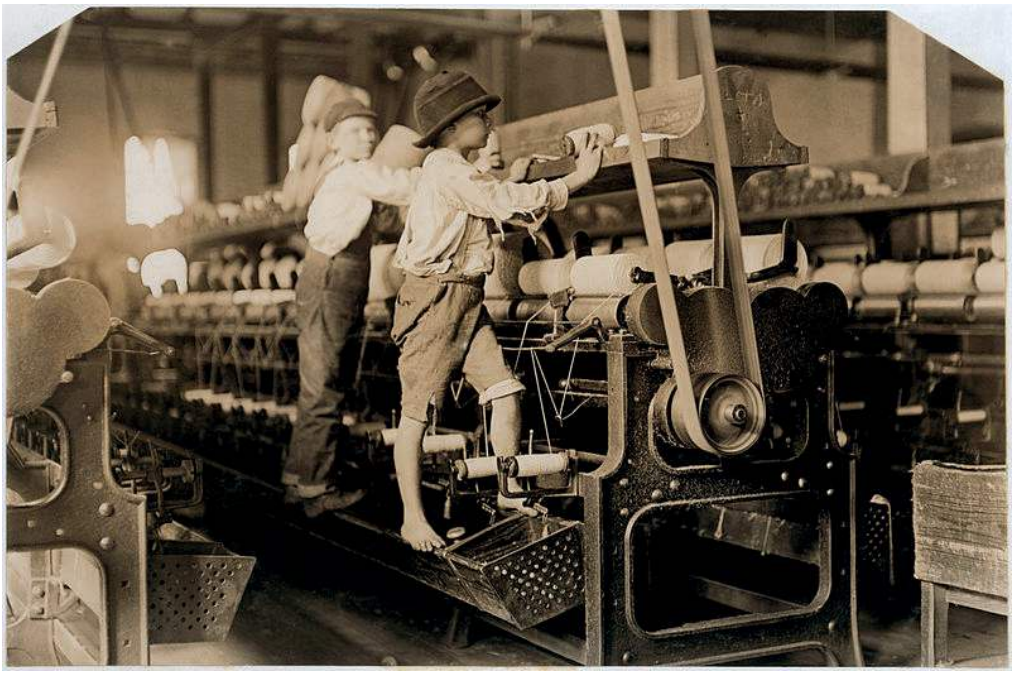
(Option D continues on the following page)

(Option D continued)

26. Health and safety in factories has improved significantly in some countries since the Industrial Revolution when there was no health and safety legislation. **Figure D4** shows a photograph of a factory during the time of the Industrial Revolution.

Figure D4: A textile factory before the introduction of health and safety legislation



[Source: http://en.wikipedia.org/wiki/File:Mill_Children_in_Macon_2.jpg, dated 1909, retouched by Jujutacular]

(a) Describe **one** health and safety issue related to the loom shown in **Figure D4.** *[2]*

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(Option D continues on the following page)

(Option D, question 26 continued)

(b) Outline **one** reason why the use of child labour in relation to maintenance issues was popular in the textile industry during the Industrial Revolution. *[2]*

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(c) Outline **one** reason why health and safety legislation is variable in the global textile industry. *[2]*

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(Option D continues on the following page)

(Option D continued)

27. The jacket in **Figure D5** incorporates smart technology with solar cells into its collar. The electricity generated can be used to charge a range of mobile devices.

Figure D5: A jacket with solar cells in the collar

Figure D5 removed for copyright reasons

(a) Suggest **one** market segment for this type of product. *[3]*

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(b) Explain **one** way that the safety of the wearer can be improved by wearing smart clothing. *[3]*

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(Option D continues on the following page)

(Option D continued)

28. Explain **three** ways that the use of computerized manufacture in the textile industry has improved the quality of products. *[9]*

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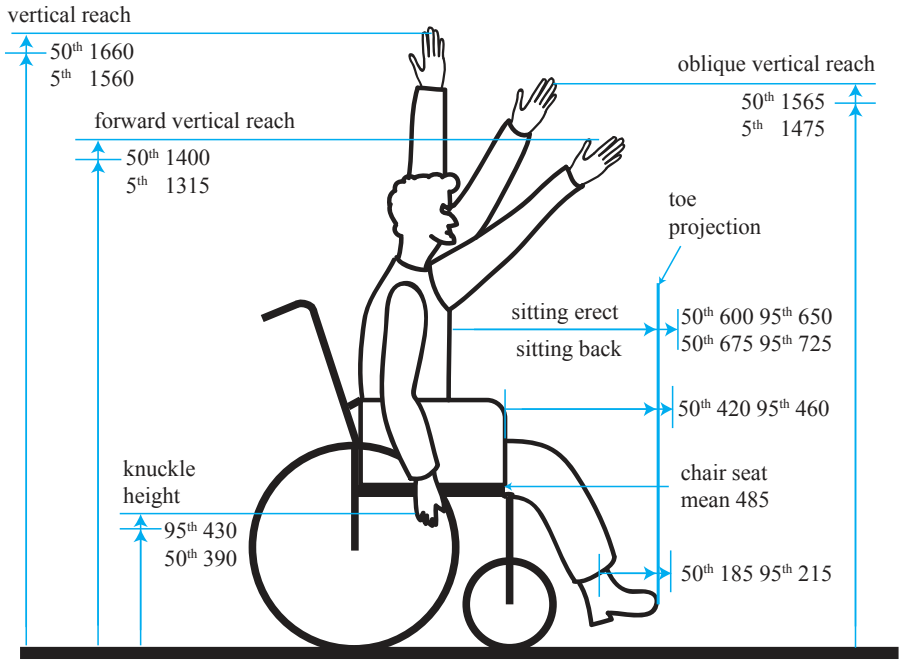
End of Option D

Option E — Human factors design

29. **Figure E1** shows percentile range data for adult male wheelchair users. All measurements are in millimetres.

Figure E1: Percentile range data for wheelchair users (mm)



[Source: © International Baccalaureate Organization 2014]

(a) State the type of data scale used for the data shown in **Figure E1**. *[1]*

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(b) Outline **one** reason why the 5th percentile is used in relation to each of the measurements associated with reach. *[2]*

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(Option E continues on the following page)

(Option E, question 29 continued)

(c) Explain why the data for toe projection is given in terms of the 50th and 95th percentiles. *[3]*

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30. (a) State which aspect of the "four pleasure framework" involves values in design. *[1]*

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(b) Outline **one** way in which mobile phone design incorporates aspects of the "four pleasure framework". *[2]*

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(Option E continues on the following page)

(Option E continued)

31. Some people have difficulty opening ring pull cans with their fingers. **Figure E2** shows the Magipull ring pull can opener – a device designed to assist people to open ring pull cans.

Figure E2: The Magipull ring pull can opener

[Source: Culinare MagiPull Blue from DKB Household. Used with permission.]

(a) Outline **one** reason why people may have difficulty opening ring pull cans with their fingers. *[2]*

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(b) Outline **one** potential disadvantage of using the Magipull ring pull can opener for able-bodied people. *[2]*

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(Option E continues on the following page)

(Option E continued)

32. **Figure E3** shows a range of cutlery called Sure grip bendable cutlery. The cutlery has large rubber handles and can be bent to suit the user (see **Figure E3** inset). **Figure E4** shows the Baroque range of cutlery manufactured from stainless steel.

Figure E3: Sure grip bendable cutlery

[Source: www.redlandhealthcare.co.uk]

Figure E4: Baroque cutlery

[Source: www.procook.co.uk]

Compare **two** human factor design features of the Sure grip bendable cutlery with those of the Baroque cutlery range. *[6]*

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(Option E continues on the following page)

(Option E continued)

33. **Figure E5** shows a hotel lounge bar.

Figure E5: A hotel lounge bar

[Source: Hilton Global Media Center.]

(a) Outline **one** way in which the mood of the bar can be easily altered for different occasions. *[2]*

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(b) Outline **one** psychological factor relating to the shape of the chairs in the bar. *[2]*

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(Option E continues on the following page)

(Option E, question 33 continued)

(c) Outline **one** way in which the designer has used texture to enhance the intimacy of the hotel lounge bar. *[2]*

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34. (a) Explain **one** way in which motion capture contributes to the development of a digital human. *[3]*

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(b) Explain **one** way in which digital human technology can be used with percentile data related to reach for wheelchair users in the design of a kitchen. *[3]*

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(Option E continues on the following page)

(Option E continued)

35. Explain **three** advantages of paper prototyping in the design of the controls for electronic products. *[9]*

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End of Option E

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