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DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 3

Candidate session number

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Tuesday 8 November 2011 (morning)

1 hour

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.

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Option A — Food science and technology

A1. **Figure A1** shows fresh and canned peaches.

Figure A1: Fresh and canned peaches

[Source: http://en.wikipedia.org/wiki/File:Autumn_Red_peaches.jpg
Created by Jack Dykinga, US Department of Agriculture.]

(a) State **one** benefit of canning peaches. *[1]*

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(b) List **two** ways in which a consumer might decide if a fresh peach is suitable for purchase. *[2]*

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(Question A1 continued)

(c) Compare fresh and canned peaches in terms of **one** organoleptic property. *[3]*

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A2. (a) State **one** reason why some metals used for food packaging need a protective coating. *[1]*

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(b) Outline **one** property of glass which is important as a food packaging material in relation to nutrition. *[2]*

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A3. Chicken tikka masala is a curry dish in which roasted chicken chunks are served in a rich red, creamy, lightly spiced, tomato-based sauce. It is a popular dish in many countries as a restaurant dish and as a ready meal to eat at home (see **Figure A2**).

Figure A2: Chicken tikka masala ready meal

(a) Outline **one** lifestyle factor which has led to the increased consumption of ready meals. *[2]*

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(b) Describe the role of market testing in the development of food products such as the chicken tikka masala ready meal. *[2]*

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A4. Outline **one** factor that relates to the need for the primary processing of orange juice. *[2]*

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A5. Discuss **two** reasons why farmers' markets have become popular in urban areas in many countries. *[6]*

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A6. Explain **three** ways in which controls are used in food manufacturing to ensure the quality of a food product. *[9]*

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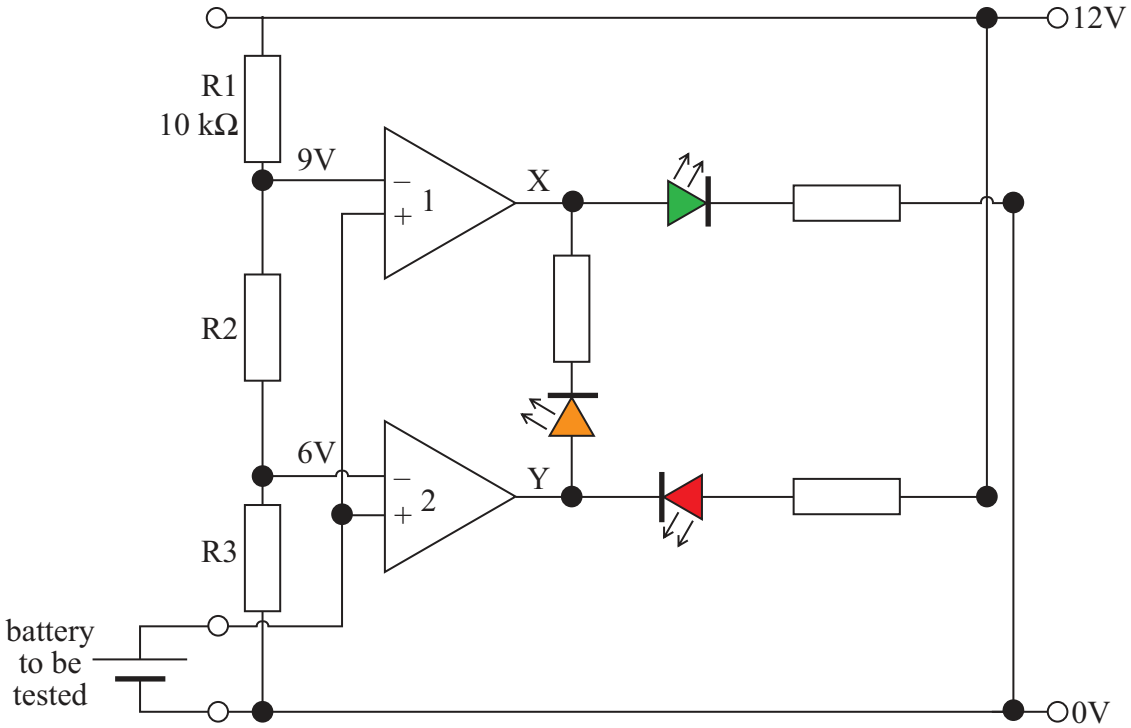
Option B — Electronic product design

B1. **Figure B1** shows the circuit for a battery tester which lights a green LED when its voltage is 9V or more, an orange LED when its voltage is between 6V and 9V and a red LED when its voltage is less than 6V. The battery to be tested is connected between 0V and the non-inverting input of the operational amplifiers.

Figure B1: Circuit for battery tester



(a) State the function of the operational amplifier when it is connected as shown in Figure B1. *[1]*

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(b) Calculate the values of R2 and R3 to input 9 volts to operational amplifier 1 and 6 volts to operational amplifier 2 shown in Figure B1. *[2]*

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(Question B1 continued)

(c) Deduce the values of the voltages at the op amp outputs X and Y in Table B1 when the battery has the voltages indicated. *[3]*

Table B1: Voltages

Voltage of battery to be tested	Voltage at X	Voltage at Y
Less than 6V		
Between 6V and 9V		
More than 9V		

B2. (a) Define *modulation*. *[1]*

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(b) Describe **one** limitation of a multi-mode optical fibre. *[2]*

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B3. **Figure B2** shows a stereo loudspeaker with an integrated amplifier and a digital input source that will produce sound when it receives a signal.

Figure B2: Stereo loudspeaker

[Source: www.sensitiveaudiovideo.com/os1/components/com]

(a) Describe why the signal between the amplifier and speaker is analogue. *[2]*

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(b) Outline **one** implication of using an open loop control system to amplify the audio signal. *[2]*

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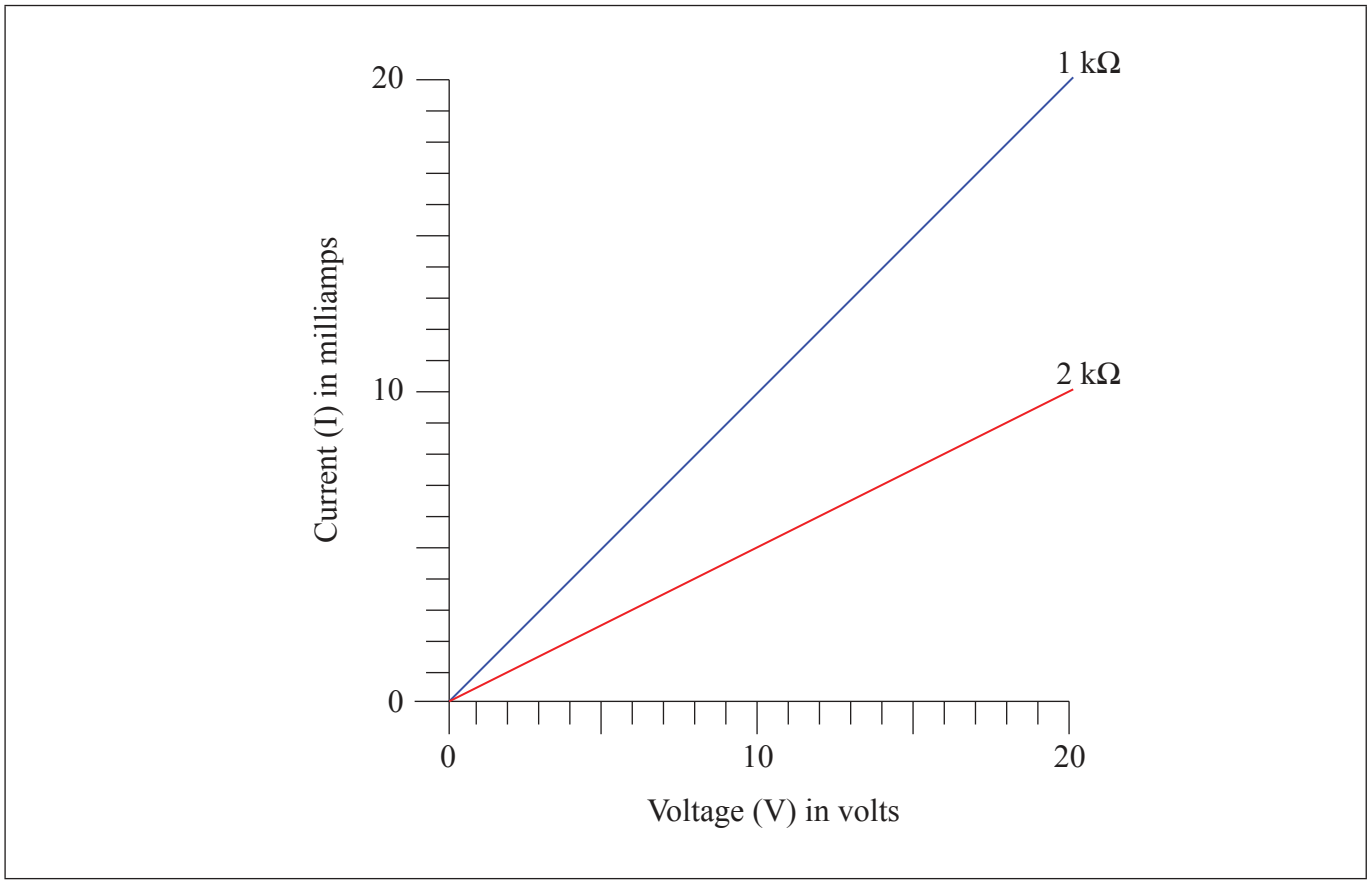
B4. The graph shown in **Figure B3** shows the relationship between current (I) and voltage (V) for a 1 kΩ and a 2 kΩ resistor.

Figure B3: Relationship between current (I) and voltage (V) for a 1 kΩ and a 2 kΩ resistor



Identify the relationship between voltage and current for a 4 kΩ resistor by drawing a line on the graph. *[2]*

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B5. **Figures B4** and **B5** shows the audiograms for two different people. On each audiogram the red line indicates the person's hearing ability in their right ear and the blue line indicates the person's hearing ability in the left ear.

Figure B4: Audiogram for person 1

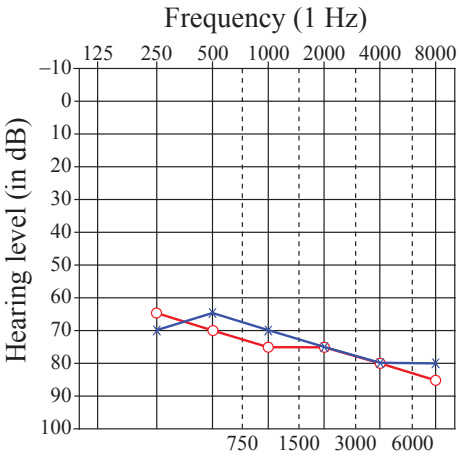
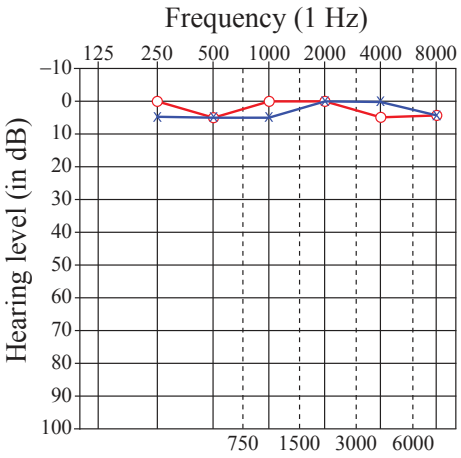


Figure B5: Audiogram for person 2



[Source: www.babyhearing.org. Used with the permission of the Boys Town National Research Hospital]

Discuss the hearing abilities of the people whose audiograms are shown in Figures B4 and B5. *[6]*

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B6. Discuss the implications of the adoption of generic standards in digital electronic products for the designer, manufacturer and consumer. *[9]*

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Option C — CAD / CAM

C1. Many signs on commercial vehicles are now manufactured using CNC equipment. A prototype of a new sign is shown in **Figure C1**.

Figure C1: Sign for commercial vehicle

[Source: http://www.beacongraphics.com/images/gx-24-extreme.jpg]

(a) State the type of CNC machine shown in Figure C1 that is used to produce the prototype sign. *[1]*

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(b) Describe how the CNC machine produces the sign. *[2]*

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(Question C1 continued)

(c) Discuss **one** issue faced by the manufacturer when choosing an appropriate CNC machine to make the sign in Figure C1. *[3]*

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C2. (a) State **one** reason why metals are cut at a slower rate than wood when using a CNC machine. *[1]*

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(b) Outline **one** limitation of using a three-axis CNC machine to make a 3D product. *[2]*

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C3. **Figure C2** shows a model of a human skull made of epoxy resin using stereo lithography.

Figure C2: Physical prototype made using stereo lithography

[Source: ProtoMED, Inc., www.protomed.net]

(a) Outline **one** advantage of stereo lithography for the production of a prototype for the designer. *[2]*

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(b) Outline **one** advantage of stereo lithography for the production of a prototype for the manufacturer. *[2]*

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C4. Outline the contribution of Just-In-Time (JIT) to a Computer Integrated Manufacturing (CIM) system. *[2]*

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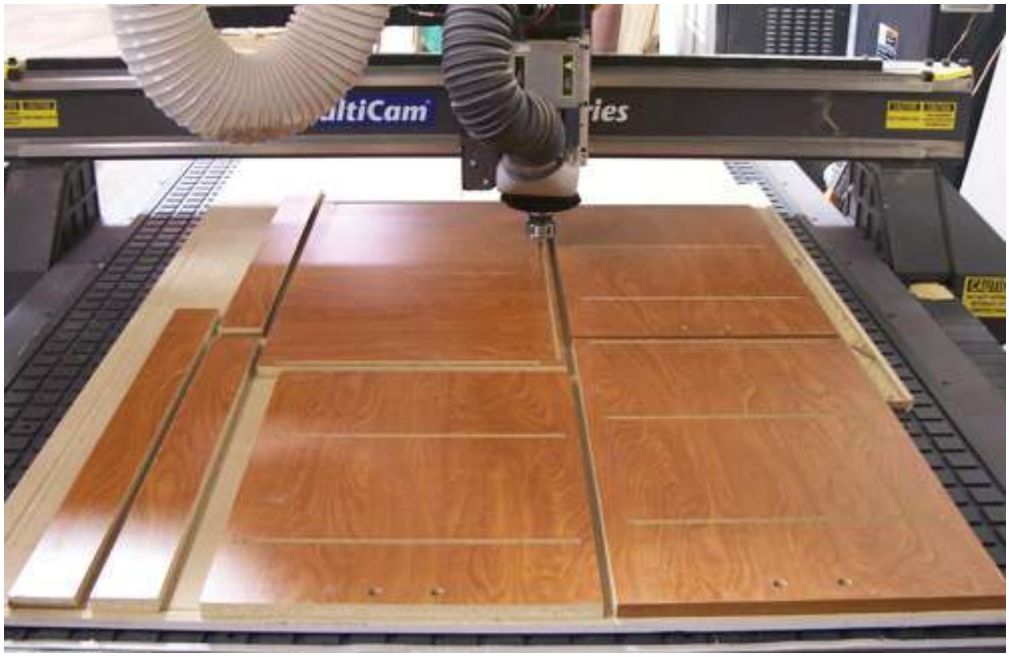
C5. **Figure C3** shows a CNC router being used in the manufacture of components for flat pack furniture.

Figure C3: CNC router used in manufacturing flat pack furniture



[Source: http://www.cncmillwork.com/img/CNC_machine_01.jpg]

Discuss **two** benefits for the manufacturer of using the CNC router to manufacture the flat pack furniture in Figure C3. *[6]*

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C6. Discuss **three** advantages of using CAD when designing electronic product housing. *[9]*

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Option D — Textiles

D1. **Figures D1**, **D2** and **D3** show some of the stages in the making of a felt hat from a flat piece of felt. In **Figure D1** the felt has been steamed to make it soft; in **Figure D2** it is shaped over a former; in **Figure D3** it is secured on the former until it dries. Once dried it is taken off the former and will stay in that shape.

Figure D1: Steamed felt

Figure D2: Felt shaped over former

Figure D3: Dried into shape on former

[Source: http://costumes.org. Used with permission.]

(a) State **one** type of natural yarn suitable for making felt. *[1]*

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(b) Outline **one** property of felt which makes it a suitable material for the hat. *[2]*

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(c) Explain **one** reason why felt is a suitable material for the volume production of hats. *[3]*

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D2. (a) Define *biomimetics*. *[1]*

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(b) Outline **one** way in which *biomimetics* has contributed to the improved performance of athletes. *[2]*

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D3. **Figure D4** shows a rucksack made from woven nylon.

Figure D4: A rucksack made from woven nylon

[Source: http://en.wikipedia.org/wiki/File:Rucksack1.jpg
Created by Wikipedia user 'Sjr' from Hessen.]

(a) Describe a suitable method of joining the strap to the body of the rucksack in Figure D4. *[2]*

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(b) Outline **one** mechanical property of nylon which makes it suitable for the rucksack in Figure D4. *[2]*

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D4. Describe how a CNC embroidery machine converts a digital image into a textile design. *[2]*

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D5. **Figures D5** and **D6** show t-shirts that have been printed using laser image transfer technology. The t-shirts are to be sold to raise money for a charity.

Content removed for copyright reasons

Discuss **two** implications of using laser image transfer technology to produce the black and white design in Figure D5 and the colour design in Figure D6. *[6]*

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D6. Discuss **three** issues related to branded clothing in the sports industry for the designer, the manufacturer and the consumer. *[9]*

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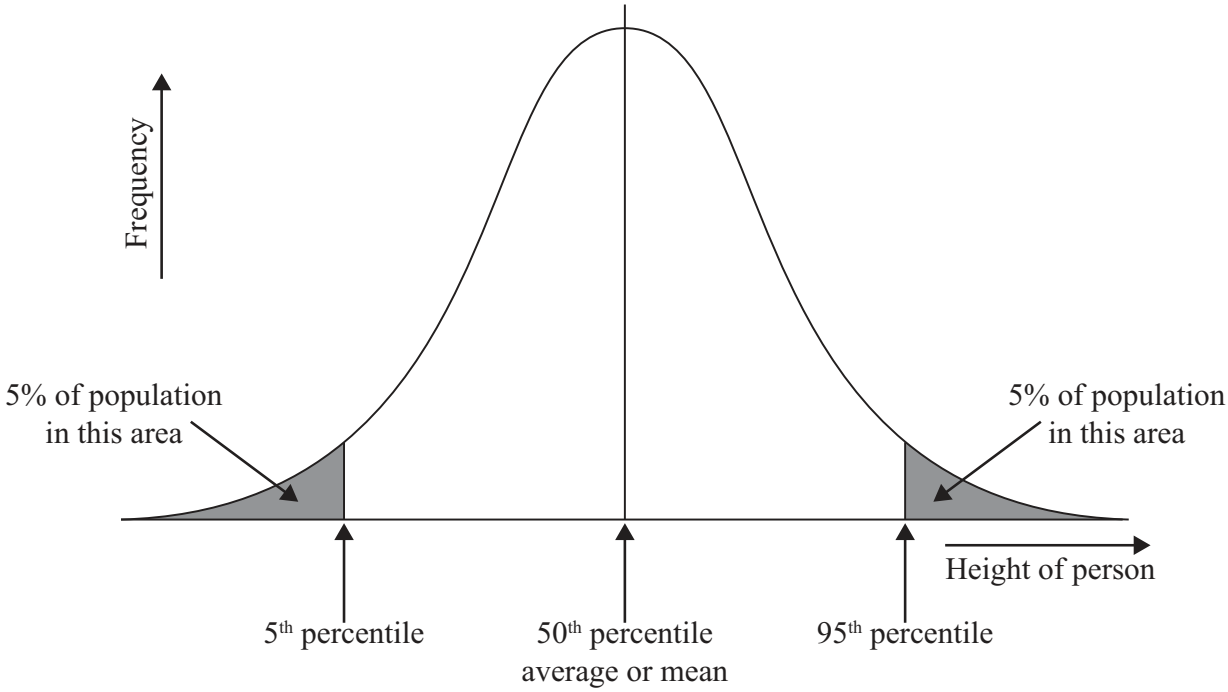
Option E — Human factors design

E1. **Figure E1** shows a graph of a normal distribution curve representing the percentile range for height of a population.

Figure E1: A bell-shaped normal distribution curve



(a) State the percentage of the population that falls between the 5th and the 95th percentile. *[1]*

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(b) Outline **one** reason why the shape of the distribution curve would change depending on the user population it represents. *[2]*

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(Question E1 continued)

(c) Explain the relevance of the shaded areas of the graph to the work of designers. *[3]*

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E2. (a) State **one** health and safety consideration relating to office workers using a computer for most of the day, every working day. *[1]*

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(b) Outline **one** way in which perceptions can affect thermal comfort when working in an open-plan office. *[2]*

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E3. **Figure E2** shows the Penagain Ergo-sof ballpen. The pen features a replaceable nib, retractable point and has a soft rubber finish. The pen is marketed as offering a more comfortable way to write.

Figure E2: The Penagain Ergo-sof ballpen

[Source: http://www.thedyslexiashop.co.uk/penagain-ergosof-pen.html, used with permission]

(a) Outline **one** reason why the Ergo-sof pen may be suitable for people with limited hand movement. *[2]*

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(b) Outline **one** advantage relating to human factors of designing the Ergo-sof pen in Figure E2 with a soft rubber finish. *[2]*

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E4. Outline **one** advantage of using an appearance prototype at the design development stage. *[2]*

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E5. **Figure E3** shows a Prima home office manufactured by the company Strachan and installed in a restricted height space such as the loft (attic) of a house.

Figure E3: Prima home office

[Source: www.strachan.co.uk. Used with permission.]

Compare **two** human factor considerations for a home office such as that shown in Figure E3 with the human factor considerations for a commercial office. *[6]*

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E6. Discuss the importance of using human factor data relating to clearance, reach and comfort in the design of the interior of an aircraft cabin. *[9]*

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