



**DESIGN TECHNOLOGY  
HIGHER LEVEL  
PAPER 3**

Thursday 13 May 2010 (morning)

1 hour 15 minutes

Candidate session number

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**INSTRUCTIONS TO CANDIDATES**

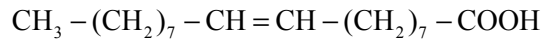
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from one of the Options in the spaces provided. You may continue your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the letters of the Options answered in the candidate box on your cover sheet and indicate the number of answer sheets used in the appropriate box on your cover sheet.



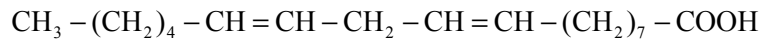
**Option A — Food science and technology**

**A1.** Olive oil is a natural product which is a complex mixture of fatty acids, vitamins, volatile components, water soluble components and small bits of olive. The fatty acids contained in olive oil are unsaturated fatty acids – oleic, linoleic and linolenic.

- Oleic acid is monounsaturated and makes up 55–85% of olive oil



- Linoleic acid is polyunsaturated and makes up about 9%



- Linolenic acid is also polyunsaturated and makes up 0–1.5%

**Figure A1: Olive oil**



[Source: [http://en.wikipedia.org/wiki/File:Italian\\_olive\\_oil\\_2007.jpg](http://en.wikipedia.org/wiki/File:Italian_olive_oil_2007.jpg)]

- (a) Define *unsaturated fatty acid*. [1]

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- (b) Describe the importance of unsaturated fats to health. [2]

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*(This question continues on the following page)*



*(Question A1 continued)*

- (c) Explain the importance of unsaturated fatty acids in the development of rancidity and the shelf life of cooking oils. [3]

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- A2. (a) Define *food insecurity*. [1]

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- (b) List **two** criteria for food security. [2]

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**A3.** Created in 1886 by Dr John S Pemberton, the Coca-Cola brand has become one of the most widely recognised globally. Since 1982 the Coca-Cola company has developed a wide range of products to meet the needs of different market segments (see **Figure A2**). These include a cherry-flavoured product, low sugar products (diet Coke and diet Coke caffeine free) and no sugar products (Coca-Cola Zero). Most recently, Coca-Cola have produced “diet Coke plus” products – diet Coke plus vitamins and diet Coke plus antioxidant.

**Figure A2: The Coca-Cola product family (original, cherry flavour, diet Coke, diet Coke caffeine free, Coca-Cola Zero, diet Coke plus vitamins and diet Coke plus antioxidants)**

**IMAGE REMOVED DUE TO COPYRIGHT REASONS.**

(a) List **two** functions of the packaging of Coca-Cola. [2]

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(b) Outline **one** way in which the packaging of Coca-Cola has contributed to the development of the Coca-Cola brand. [2]

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**A4.** (a) Explain the significance of the resistance of crops to the herbicide Roundup™. [3]

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(b) Discuss **one** reason why manufacturers might not want to label genetically-modified crops or their products. [3]

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

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(b) Describe the temperature danger zone for bacterial growth. [2]

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(c) Outline **one** way in which lifestyle factors contribute to the increased incidence of food poisoning. [2]

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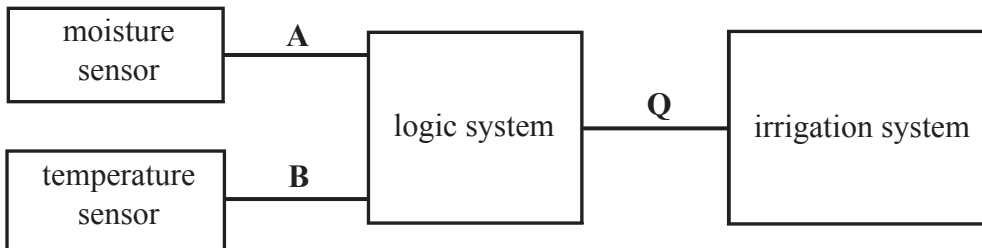




**Option B — Electronic product design**

**B1.** A digital control system is used to activate a garden irrigation system (see **Figure B1**). The moisture sensor provides logic 1 when the soil is too dry for the plants to remain healthy. The temperature sensor provides logic 1 when the temperature exceeds 25°C. The irrigation system is activated by logic 1. The irrigation system needs to be activated when the soil is too dry for the plants, but only if the temperature is less than 25°C.

**Figure B1: Digital control system to activate a garden irrigation system**



(a) Identify the key component of the temperature sensor. [1]

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(b) Complete the truth table for the logic system. [2]

A	B	Q
0	0	
0	1	
1	0	
1	1	

(c) Draw the circuit diagram for the logic system. [3]



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

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(b) Describe **one** application of nanotechnology. [2]

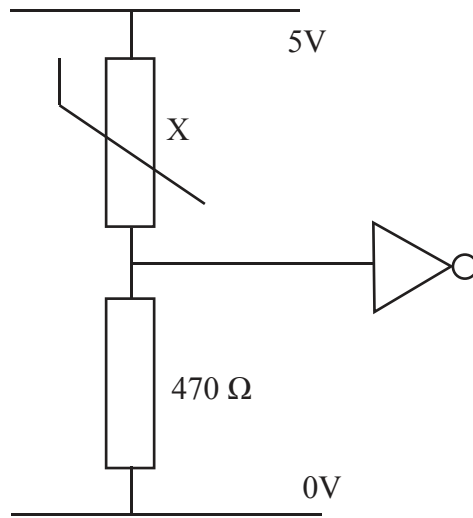
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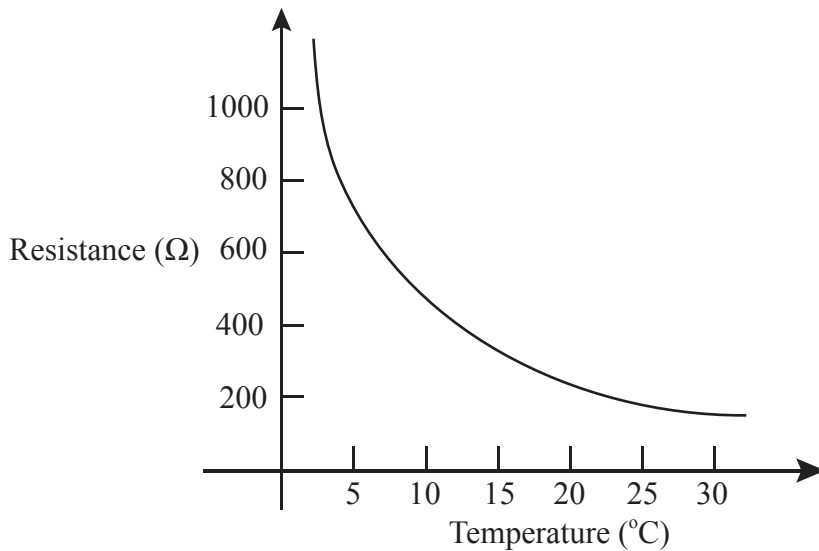


**B3.** **Figure B2** shows the input to a logic system used in a temperature control system for a smart home. **Figure B3** shows the characteristics of thermistor X.

**Figure B2: Input to a logic system for a temperature control system in a smart home**



**Figure B3: The characteristics of thermistor X in Figure B2**



(a) State the resistance of thermistor X at 10°C. [1]

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(b) Explain why thermistor X can be used to provide logic 0 when the temperature rises above approximately 10°C in the logic system shown in Figure B2. [3]

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**B4.** (a) Explain how PICs are integrated into control circuits to implement the smart home concept. [3]

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(b) Explain how a door can be locked and unlocked electronically using PIC technology. [3]

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**B5.** (a) Outline **one** implication of product stewardship for designers. [2]

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(b) Outline **one** way in which take-back legislation will impact on the cost of a product. [2]

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(c) Outline **one** way in which service costs contribute to the replacement of electronic products rather than their repair. [2]

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**Option C — CAD / CAM**

**C1.** **Figure C1** shows a wardrobe that was supplied as a flat-pack for self assembly. The pack includes all the necessary components and instructions for assembly. The instructions use exploded drawings of sections of the wardrobe.

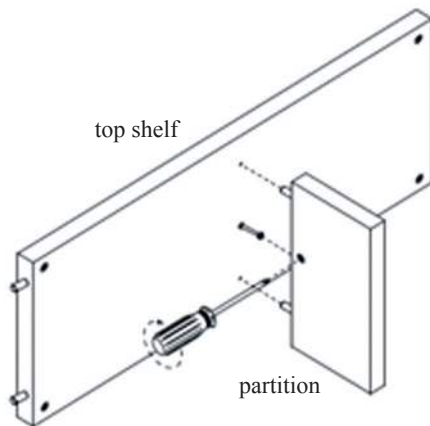
**Figure C1 (a): Self-assembly wardrobe**



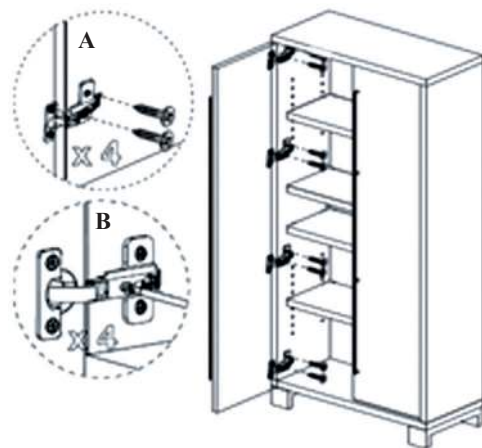
**Figure C1 (b): Knock-down fittings**



**Figure C1(c): Assembly instructions**



**Figure C1 (d): Assembly instructions**



[Source: [www.cb2.com/assembly/cadet\\_wardrobe.pdf](http://www.cb2.com/assembly/cadet_wardrobe.pdf)]

(a) State **one** benefit for the consumer of using knock-down (KD) fittings in the design of the wardrobe in Figure C1. [1]

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(Question C1 continued)

- (b) Describe how the exploded drawing in Figure C1 will help consumers to assemble the wardrobe. [2]

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- (c) Discuss **one** advantage of using CAM in the manufacture of flat-pack furniture. [3]

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- C2.** (a) Define *artificial intelligence*. [1]

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- (b) Outline **one** way in which feedback plays an important role in developing artificial intelligence. [2]

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C3. Figure C2 shows different views of a ring produced using CAD.

Figure C2: CAD image of a ring



[Source: www.compufield.com]

(a) Outline how the use of CAD has simplified the designing of jewelry. [2]

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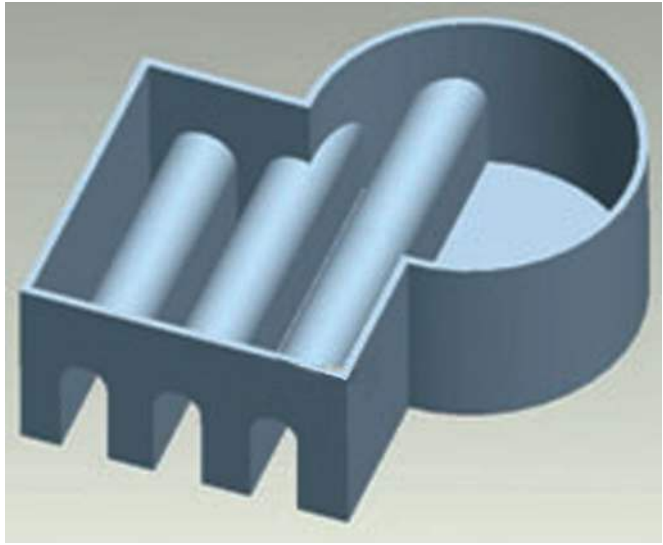
(b) Outline how a scanner could be used to aid jewelry design using CAD. [2]

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C4. **Figure C3** shows a CAD image of the housing for an electronic product.

**Figure C3: CAD image of the housing for an electronic product**



Discuss **two** limitations of using 3-axis machining to make the product in Figure C3.

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**C5.** (a) Outline how CAD has changed the nature of the designer-client relationship. [2]

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(b) Identify **one** advantage of using CAD in terms of working across time zones. [2]

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(c) Outline **one** implication of computerized manufacture on the infringement of copyright laws. [2]

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C6. Figures C4 and C5 show two different chair designs manufactured using different techniques.

Figure C4: Ben Wilson’s Chairfix design

Figure C5: Gerrit Rietveld’s Mondrian inspired chair.



[Source: Chairfix by Ben Wilson (www.benwilsondesign.co.uk)]

[Source: http://en.wikipedia.org/wiki/File:Rietveld\_chair\_1.JPG]

(a) Discuss **one** issue associated with using MDF as a material to make the chair in Figure C4 in a CAM system. [3]

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(b) Compare the use of CAM to make the chair in Figure C4 to that of using more traditional techniques to make the chair in Figure C5. [3]

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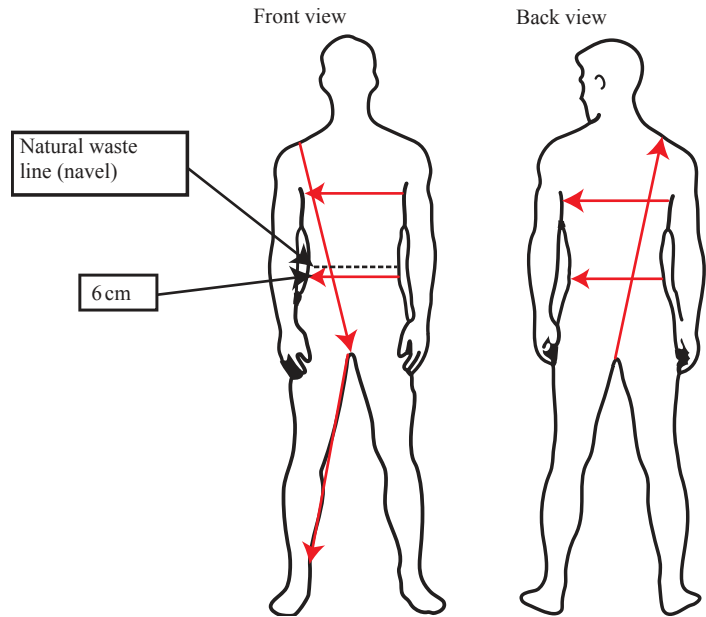
**Option D — Textiles**

**D1.** Speedo, a company producing swimwear, has invested in research to design fabrics that are able to enhance the performance of competitive swimmers by reducing drag as they move through the water. **Figure D1** shows a bodysuit made of Fastskin® – a biomimetic fabric. Fastskin® has “super-stretch” characteristics which improve shape retention and increases muscle compression to reduce vibration and retain muscle shape reducing fatigue and power loss. Fastskin® is a composite of polyamide, a synthetic textile fibre, and Lycra®. The bodysuit has to fit like a second skin and is made in a range of sizes to ensure it fits well (see **Figure D2**).

**Figure D1: Speedo bodysuit**



**Figure D2: Measuring for a bodysuit**



[Source: <http://store.speedo.co.uk> Copyright Speedo International. Reproduced with permission]

(a) Define *biomimetic*. [1]

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(b) Outline **one** reason why the bodysuit has to fit like a second skin. [2]

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*(Question D1 continued)*

- (c) Explain **one** reason why a composite material is used for the manufacture of Fastskin®. [3]

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- D2.** (a) State **one** impact of mechanization in the textile industry on the family life of textile workers. [1]

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- (b) Outline **one** impact of automation of the textile industry on the working conditions of the workforce. [2]

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**D3.** **Figure D3** shows a 6-needle embroidery system suitable for small-scale commercial use and for education. The embroidery system has a range of inbuilt designs and users can create their own designs on a PC and transfer them to the system for sewing.

**Figure D3: 6-needle embroidery system**



[Source: Image source – Brother Industries Ltd Nagoya, Japan]

(a) Describe the market for products developed using the embroidery system. [2]

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(b) Outline **one** way in which the embroidery system can help to enhance designer-client relationships. [2]

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**D4.** (a) Explain how manufacturers would achieve the “EU Flower” system for a textile product. [3]

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(b) Discuss the key environmental impacts associated with the cutting of cotton fabrics. [3]

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**D5.** (a) Identify **one** input device for use with wearable computing. [2]

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(b) Identify **one** obstacle to the expansion of the wearable computing market. [2]

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(c) Outline **one** benefit of laser welding as a joining technique for the manufacture of wearable computing garments. [2]

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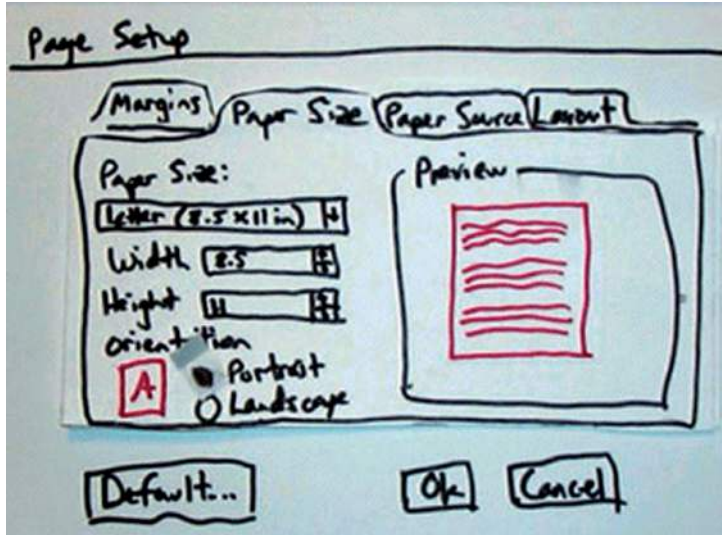




**Option E — Human factors design**

**E1.** **Figure E1** is a paper prototype of a page set up from Microsoft Word, a word processing programme.

**Figure E1: Paper prototype**



[Source: This figure is used by permission from the book Paper Prototyping, by Carolyn Snyder, published by Morgan Kaufmann Publishers, Copyright 2003 Elsevier Inc. All rights reserved]

(a) State **one** advantage of paper prototyping. [1]

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(b) Outline **one** way in which paper prototyping can be seen as an example of participatory design. [2]

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(c) Explain the role of the user in a paper prototyping session. [3]

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**E2.** (a) State **one** advantage of motion capture for digitally representing motion. [1]

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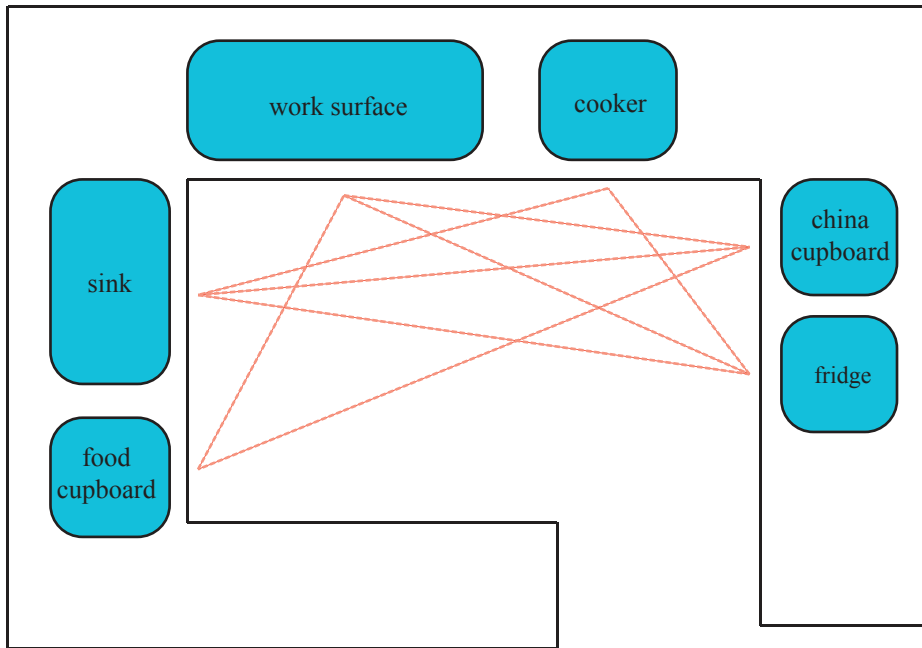
(b) Outline **one** way in which digital humans increase the pace of the product development cycle. [2]

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E3. Figure E2 shows the use of work triangles in a kitchen layout design.

Figure E2: Work triangles in a kitchen layout design



(a) Describe the relationship between work triangles to kitchen layout design. [2]

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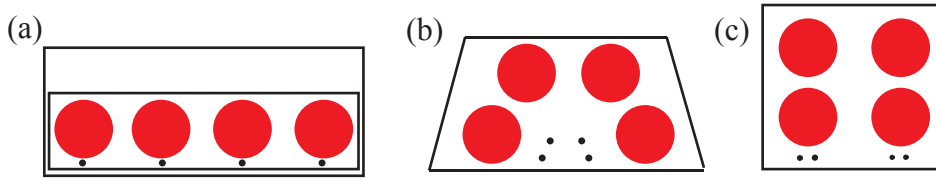
(b) Outline how the use of a work triangle may assist a designer to resolve safety issues in the design of a kitchen layout. [2]

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E4. Figure E3 shows three possible layouts for a cooker hob with four burners and four control knobs.

Figure E3: cooker hob layouts



Discuss **two** issues for the designer in deciding which layout should be adopted as the standard design.

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E5. (a) Outline **one** advantage of globalization to the manufacturer of products for people with a disability.

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(b) Outline **one** benefit of increased access to the internet for consumers with a disability.

[2]

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*(Question E5 continued)*

- (c) Identify **one** barrier of the use of global legislation for ensuring inclusive design for community facilities. [2]

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- E6.** (a) Suggest **one** reason why international standards are important in the design of road signs. [3]

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- (b) Explain **one** human factor consideration for designers of freeway (motorway) signs. [3]

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