



22116206

**DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 3**

Tuesday 10 May 2011 (morning)

1 hour

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.

Option A — Food science and technology

- A1.** The website of the McDonald's fast food company allows customers to access nutritional information for their meals. **Figure A1** shows data for a meal comprising of a cheeseburger, a large portion of french fries and a medium chocolate milkshake. The results are compared with the Guideline Daily Amounts (GDAs) for average adults. The average adult women's GDAs are: energy–2000 calories; fat–70 g of which saturates 20–g; salt 6–g.

Image and question (a) removed for copyright reasons

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(Question A1 continued)

- (b) Outline **one** reason why a balanced diet should contain some fat. [2]

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- (c) Explain **one** implication of excess fat intake for health. [3]

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- A2. (a) State the range of body mass index (BMI) that is considered to be overweight. [1]

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- (b) Outline **one** limitation of using BMI as a health indicator. [2]

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A3. Figure A2 shows a tomato which has been spoiled.

Figure A2: Spoiled tomato



[Source: <http://en.wikipedia.org/wiki/File:moldytomato2500ppx.jpg>]

- (a) Identify the type of spoilage shown in Figure A2. [2]

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- (b) Outline how sun drying of tomatoes preserves them. [2]

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- A4.** Outline **one** important consideration relating to the selection of the members of a taste panel. [2]

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- A5.** Explain **two** lifestyle issues which have contributed to an expanded market for organic products in some countries. [6]

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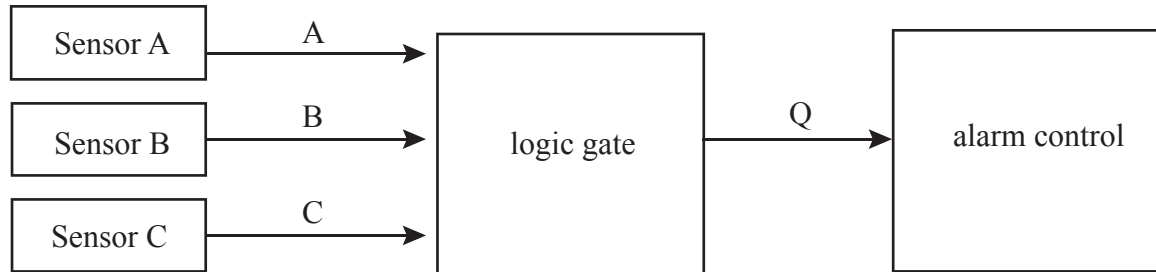
[9]

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Option B — Electronic product design

- B1.** A security system has three sensors: A, B and C, which activate an alarm if an intruder is detected. Each sensor passes logic 1 to the logic gate if an intruder is detected in its zone. The alarm control system is activated when the logic gate provides logic 1.

Figure B1: Control circuit for a security system



- (a) State the logic gate required for the security system.

[1]

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- (b) Draw the truth table for all possible combinations of inputs.

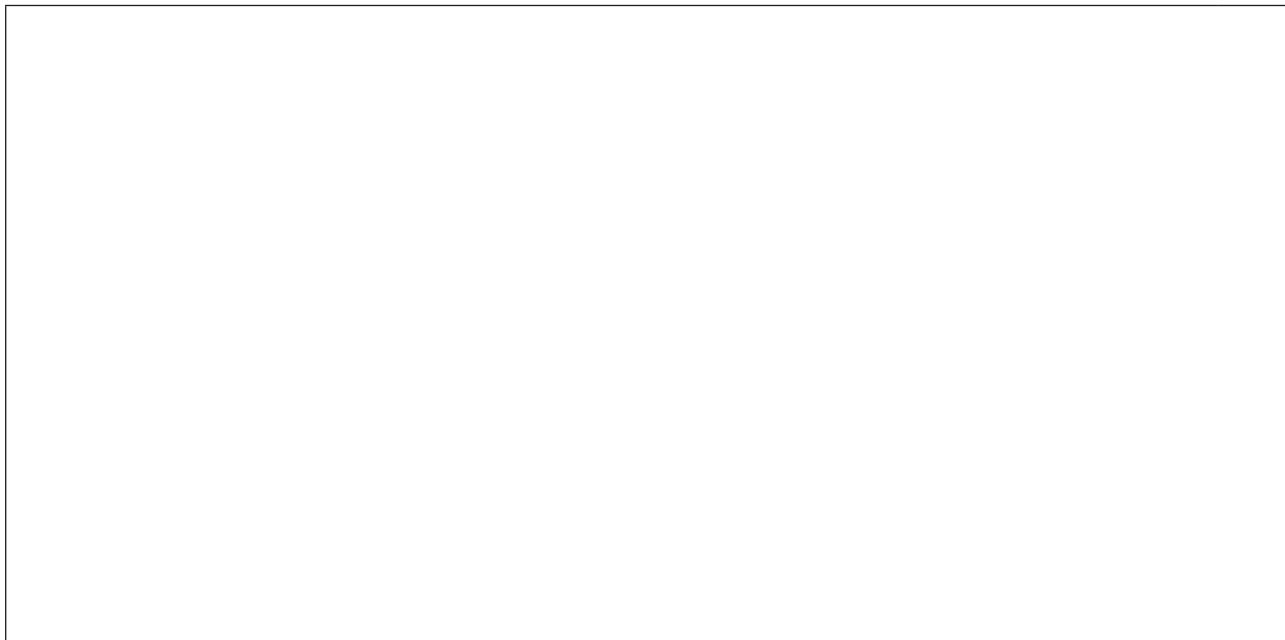
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Turn over

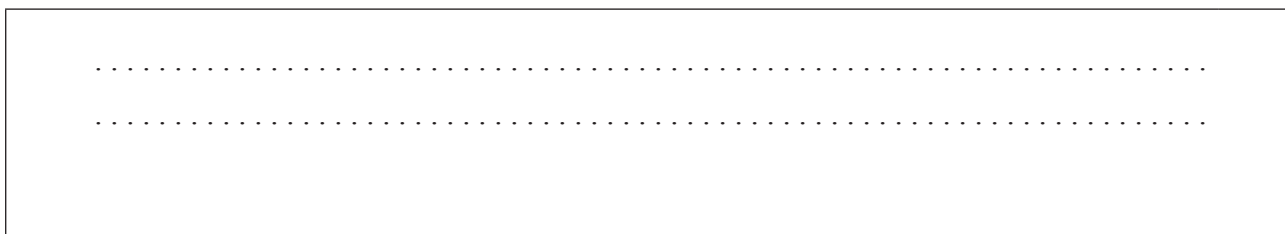
(Question B1 continued)

- (c) Sensor A is a pressure pad, placed underneath a carpet in the entrance to zone A. It acts as a push switch and is closed when an intruder steps on it. Draw a circuit for sensor A. It must provide logic 1 when the switch is pressed and logic 0 at all other times. [3]

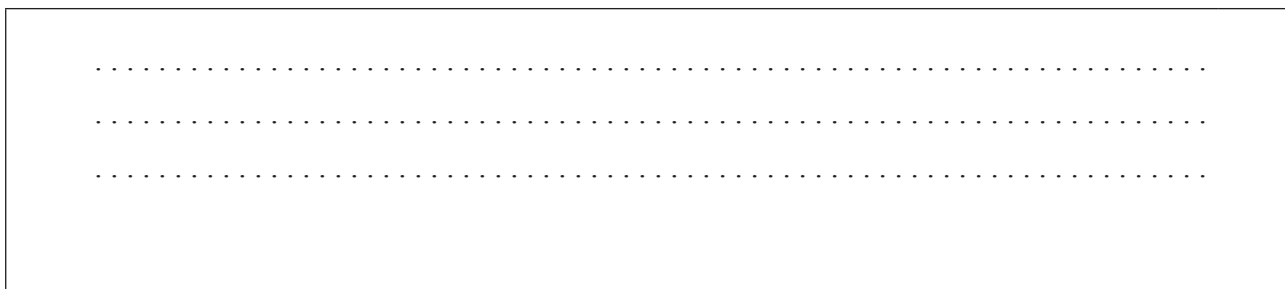


B2. Solar cells can be used to charge batteries during the day in order to provide light at night. One such system charges 6 Volt batteries.

- (a) Calculate the current taken from the battery to power a 3 Watt bulb. [1]



- (b) List **two** reasons why solar cell technology is particularly suitable for remote areas in developing countries. [2]



- B3.** (a) Outline **one** difference between a digital and an analogue signal. [2]

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- (b) Outline **one** reason why a Schmitt trigger NOT gate is more suitable than a standard NOT gate when converting an analogue signal to a digital signal. [2]

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- B4.** List **two** reasons why programmable interface controllers (PICs) are present in many modern electronic products. [2]

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- B5.** Discuss **one** advantage and **one** disadvantage for an Internet service provider operating a satellite-based system rather than an optical fibre-based system.

[6]

Advantage:

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Disadvantage:

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- B6.** Explain the importance of global standards for digital electronic products and the benefits for users and manufacturers.

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Option C — CAD/CAM

- C1.** **Figure C1** shows a ring using two forms of CAD modelling – solid modelling and wire frame modelling.

Figure C1: CAD model of a diamond ring

Image removed for copyright reasons

[Source: www.diamondgallerynaperville.com/media/upload/image/custom/diamond-half-wireframe.jpg]

- (a) State **one** advantage of wire frame modelling for the manufacturer. [1]

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- (b) Outline **one** advantage of the solid model for the client. [2]

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(Question C1 continued)

- (c) Explain **one** implication of the use of the CAD model of the ring for cost effectiveness of production. [3]

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- C2.** (a) State **one** limitation of using a three-axis machine when making a product. [1]

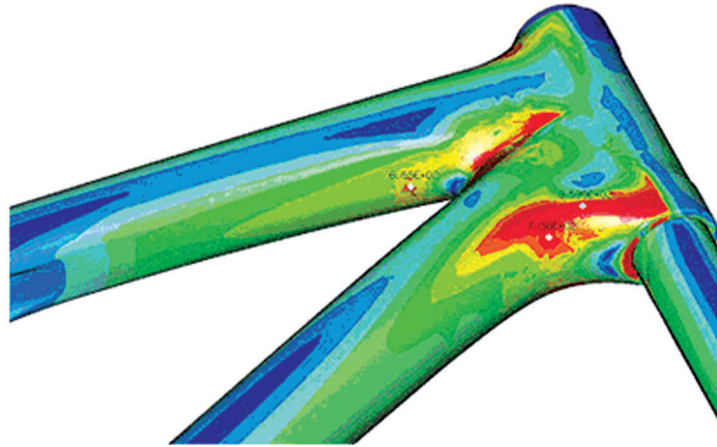
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- (b) Outline **one** advantage of using a three-axis machine over using a five-axis machine when making a product. [2]

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C3. Figure C2 shows finite element analysis (FEA) data for part of a bicycle frame.

Figure C2: FEA of part of a bicycle frame



[Source: www.designworldonline.com/ArticleDetails.aspx?id=3611]
Used with the permission of Santa Cruz Bicycles.

(a) Describe what the colours on Figure C2 mean.

[2]

(b) Outline how the FEA image data shown in Figure C2 would be used by a designer.

[2]

C4. Outline **one** subtractive manufacturing technique.

[2]

- C5.** CAD software can be used to slice a solid model into thin sections. A vinyl cutter is used to cut the slices out of sticky-backed paper. The layers of paper can then be built into a 3D model. This process is called laminated object manufacture (LOM).

Figure C3: Laminated object manufacture using Boxford's RapidPro



[Source: www.boxford.co.uk/boxford/docs/products/rapid.htm]
www.boxford.co.uk. Used with permission

Discuss **two** limitations of being able to rapid prototype the object in Figure C3 using LOM rather than other rapid prototyping techniques.

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Option D — Textiles

D1. **Figure D1** shows a boy flying a kite. **Figure D2** shows a kite made of ripstop nylon.

Figure D1: Boy flying a kite

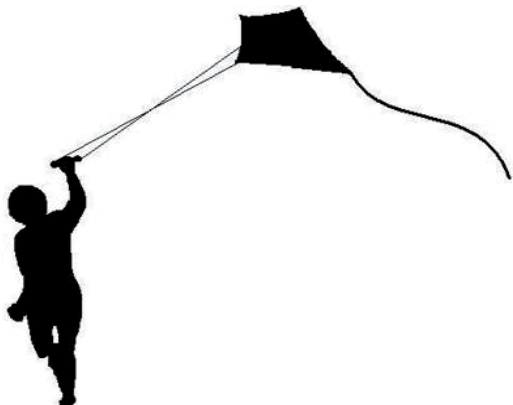
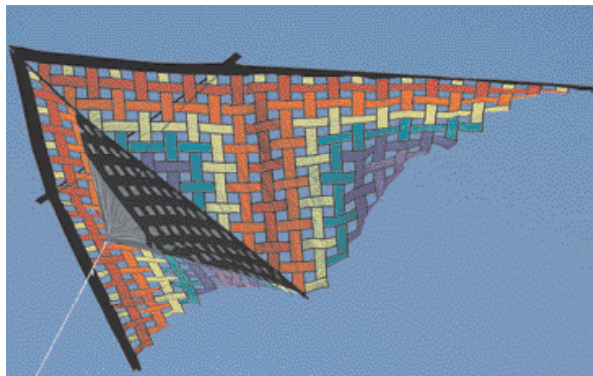


Figure D2: Kite made of ripstop nylon



[Source: http://www.cornerstonearts.org/Newsletters/April_2009.php]

- (a) State **one** aspect of the specification of the material for the kite.

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- (b) Outline **one** aesthetic consideration which makes nylon a suitable material for use in the production of the kite.

[2]

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(Question D1 continued)

- (c) Explain how the characteristic of ripstop would be manufactured into the nylon for the kite. [3]

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- D2.** (a) State **one** natural fibre used in lace-making. [1]

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- (b) Outline **one** disadvantage of using lace for producing a tablecloth. [2]

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- D3.** (a) Describe the sublimation printing process. [2]

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- (b) Outline **one** limitation of using the sublimation printing process. [2]

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- D4.** Describe the purpose of spinning when making yarn. [2]

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D6. Discuss **three** ways in which the use of CAD/CAM in the textile industry has helped to minimize waste.

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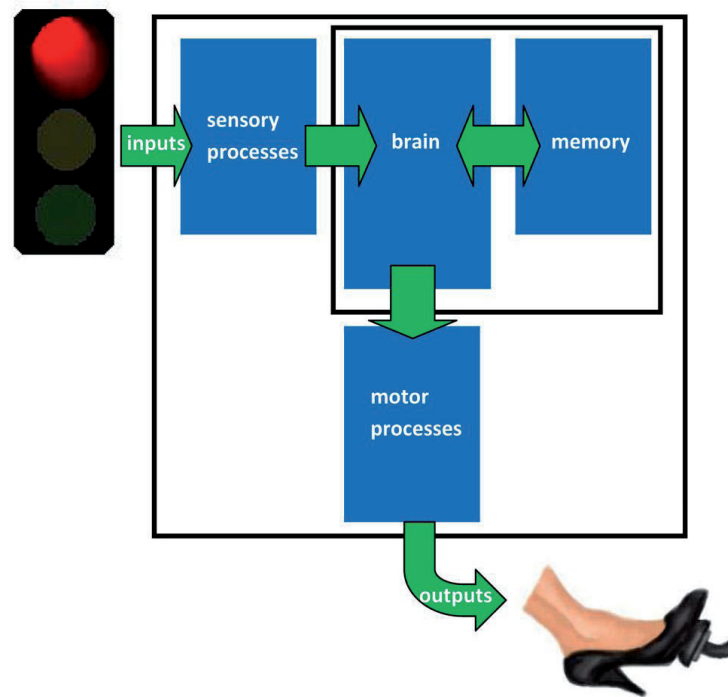
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Option E — Human factors design

E1. **Figure E1** shows the human information-processing system in operation when a car is being driven.

Figure E1: Human information-processing system



- (a) State which part of the human information-processing system is represented by a physiological action. [1]

- (b) Describe the sensory process in the human information-processing system. [2]

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(Question E1 continued)

- (c) Explain the function of memory in the human information-processing system. [3]

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- E2. (a) Define *user population*. [1]

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- (b) Describe the use of the concept of “methods of extremes” to limit sample sizes. [2]

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E3. **Figure E2** shows the Ad-specs. They are “adaptive spectacles” which have been designed for use by people in developing countries. The focal length of the lenses is easily adjusted by filling the lens with fluid using the adjustment wheels and pump. No sight test is required. For everyday use (once the focal length of the lenses has been adjusted) the pump can be removed (see **Figure E3**).

Figure E2: Ad-specs



Figure E3: Ad-specs in use with pump removed



[Source: www.adaptive-eyecare.org]
Used with permission: www.vdwoxford.org

- (a) Outline **one** reason related to human factors for the size of the lenses of the Ad-specs. [2]

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- (b) Outline **one** aspect of the design of the spectacles which has been compromised by the size of the lenses. [2]

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E4. Describe why mapping is an important consideration in human factors design.

[2]

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E5. **Figure E4** shows the Forest chair manufactured by Fast Italy. It is made from metal and is designed for use in the garden.

Figure E4: Forest Chair



Fast Italy forest garden armchair, designed by Robby and Francesca Cantarutti
www.gomodern.co.uk. Used with permission.

Discuss **two** physiological human factors issues in relation to the Forest chair.

[6]

[illegible]

- E6.** **Figure E5** shows an “Eye Level Cooker” manufactured by Flavel. By positioning the grill at eye-level the cooker was seen as a radical new design 40 years ago.

Figure E5: An “Eye Level Cooker”



Image: BEKO

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(Question E6 continued)

Discuss **three** safety issues concerning the use of the grill shown in Figure E5.

[9]

[illegible]