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DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 3

Monday 12 November 2012 (morning)

1 hour 15 minutes

Candidate session number

| 0 | 0 | | | | | | | | |

Examination code

| 8 | 8 | 1 | 2 | – | 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 A — Food science and technology

A1. Primary processing of cereal grains, such as wheat (see **Figure A1**), to produce white flour removes the fibrous husks as bran and the wheat germ leaving the carbohydrate-rich endosperm. The husks contain most of the dietary fibre so that white flour has lower dietary fibre content than wholewheat flour.

Figure A1: Wheat grain showing starchy endosperm, germ and bran

Beard

Starchy endosperm

Bran

Germ
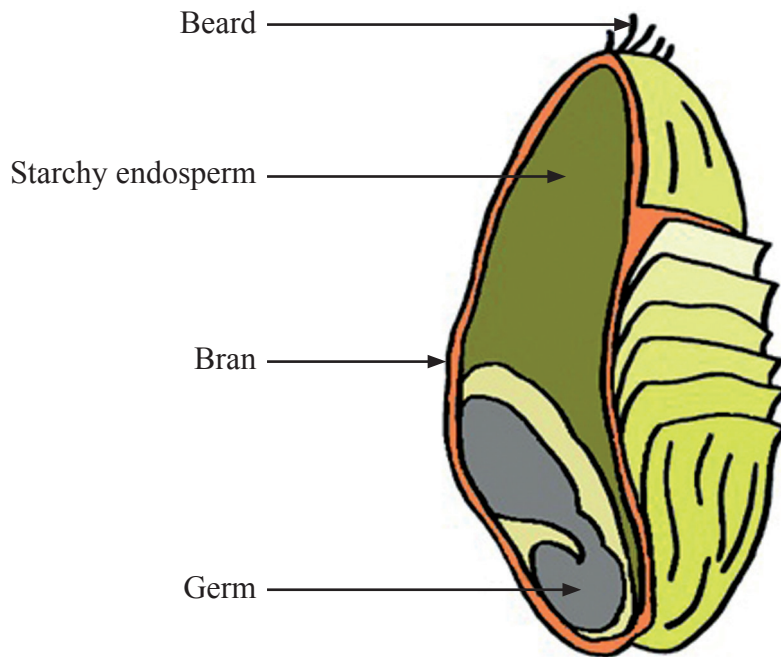
[© International Baccalaureate Organization, 2013]

(a)   State **one** benefit of primary processing of wheat to produce white flour. *[1]*

(b)   Outline **one** effect of excess carbohydrate intake. *[2]*

(This question continues on the following page)

(Question A1 continued)

(c)   Discuss how health awareness affects food choice in relation to fibre intake.   *[3]*

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A2.   (a)   State **one** concern relating to the genetic modification of food crops.   *[1]*

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(b)   Outline **one** reason why public acceptance of genetically-modified foods is important.   *[2]*

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Turn over

A3. **Figure A2** shows the label from a pasta ready meal product produced by Tesco Stores Ltd. The label offers allergy advice. The label states that the recipe has no nuts and the factory has no nuts but that the ingredients cannot be guaranteed to be nut free.

Figure A2: Label from a pasta ready meal

Image removed for copyright reasons
Please refer to the image at www.dcs.shef.ac.uk/~mark/blog/
blog_files/food_and_drink/pasta_label.jpg.

(a)   List **two** symptoms of nut allergy.   *[2]*

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(This question continues on the following page)

(Question A3 continued)

(b)   Outline **one** reason why the label offers information relating to nuts.   *[2]*

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A4.   Explain, using an example of each, how chronic and acute food-related issues impact on a
developed country's health services.   *[6]*

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A5. The first Millennium Development Goal (MDG1) is to **Eradicate extreme poverty and hunger**. However as stated by Joachim von Braun, Director General of the International Food Policy Research Institute, "The world has made only slow progress in reducing hunger in past decades, with dramatic differences among countries and region. Population and income growth, high energy prices, biofuels, science and technology, climate change, globalization, and urbanization are introducing drastic changes to food consumption, production, and markets".

[Source: www.ifpri.org/pressrelease/new-global-hunger-index]

(a) Outline **one** way in which population growth poses challenges to the achievement of MDG1. *[2]*

(b) Outline **one** way in which climate change contributes to food insecurity and the achievement of MDG1. *[2]*

(c) Outline **one** reason why the production of higher yielding cultivars of food crops is a more ethically-appropriate solution than genetic engineering for combating food insecurity. *[2]*

A6. (a) Explain **one** way in which an understanding of temperature growth curves for food bacteria influences the design of individual ready meals. *[3]*

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(b) Suggest **one** reason why the increased consumption of ready meals in developed countries may be a factor in the rise of food poisoning incidents. *[3]*

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A7. Explain how **three** different corporate strategies have contributed to the development of the global brand of Coca-Cola®. *[9]*

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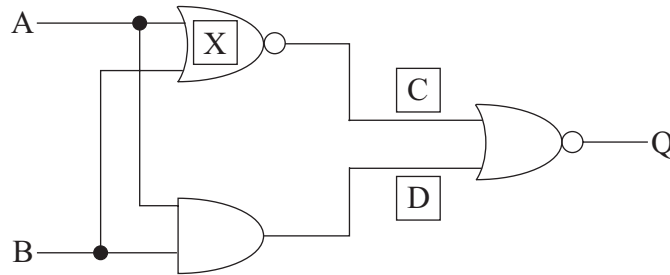
Option B — Electronic product design

B1. **Figure B1** shows a logic circuit diagram for an alarm system combining two inputs and three logic gates with a number of possible outcomes.

Figure B1: Logic circuit diagram for an alarm system

[© International Baccalaureate Organization, 2013]

(a)   State the type of logic gate for X.   *[1]*

(b)   Describe how an analogue signal can be converted to a digital signal in the control system of the alarm.   *[2]*

(This question continues on the following page)

(Question B1 continued)

(c) Determine the outcomes for C, D and Q for all the combinations of variables A and B by completing the truth table in Table B1. *[3]*

Table B1: Truth table

A	B	C	D	Q
0	0			
0	1			
1	0			
1	1			

B2. (a) Define the concept of a *smart home*. *[1]*

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(b) Outline **one** input device for a lighting system in a smart home. *[2]*

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B3. An incomplete comparator circuit is shown in **Figure B2** below where the operational amplifier V_A requires a reference voltage of 3 V.

Figure B2: Part of a comparator circuit

[© International Baccalaureate Organization, 2013]
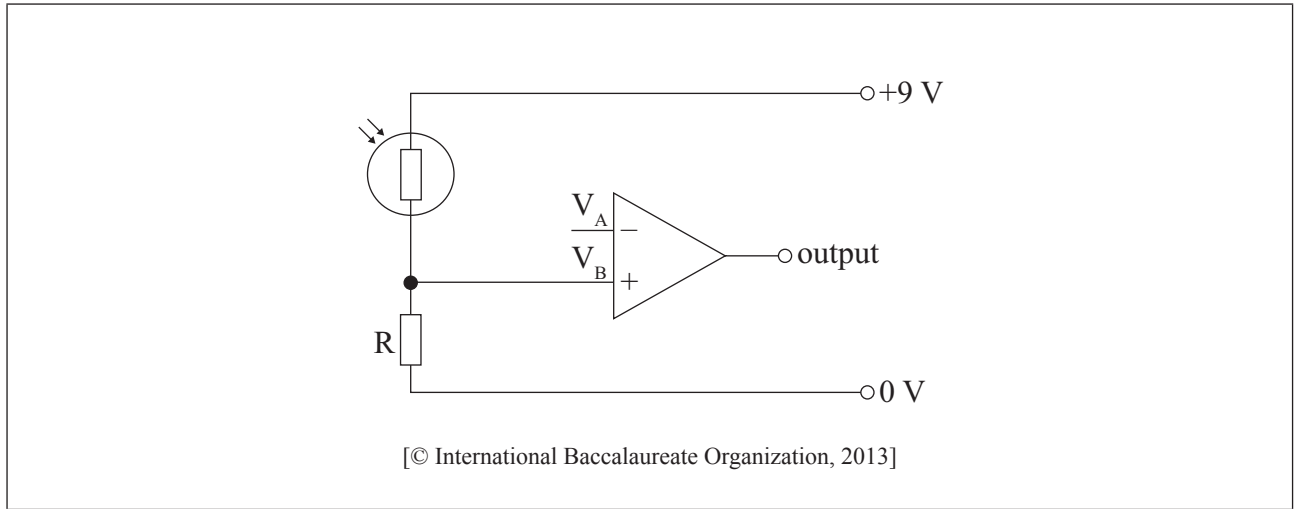
(a) Draw **two** components and their connections on the circuit diagram shown in Figure B2 to demonstrate how the reference voltage could be achieved.   *[2]*

(b) Identify what would determine the upper and lower extremes of the range of appropriate ratings for the components you added in response to part (a).   *[2]*

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B4. Discuss **two** ways in which PIC technology can be regarded as sustainable.   *[6]*

B5. (a) Outline **one** reason why very high speed data transmission is needed in the implementation of "*The Communicator*". *[2]*

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(b) Outline **one** key component of "*The Communicator*". *[2]*

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(c) Describe **one** way in which "*The Communicator*" can enhance productivity for a multi-national company. *[2]*

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B6. (a) Discuss **one** advantage for the consumer of a mobile phone designed for disassembly. *[3]*

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(b) Explain **one** issue for a designer of mobile phones relating to take-back legislation in the disposal of electronic products. *[3]*

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B7. Explain **three** advantages of using optical fibre for transferring information in a communication system. *[9]*

Option C — CAD/CAM

C1. **Figure C1**, **Figure C2** and **Figure C3** show three stages of the development of a boat hull using CAD/CAM.

Figure C1: CAD image of boat hull.	**Figure C2: Geocam software calculating tool path.**	**Figure C3: Simulation of milling boat hull.**
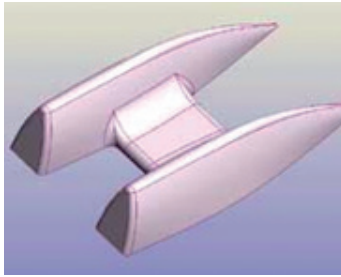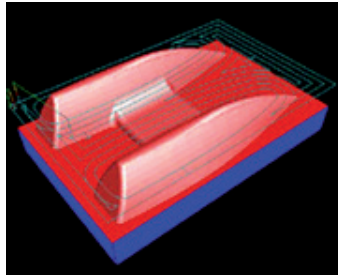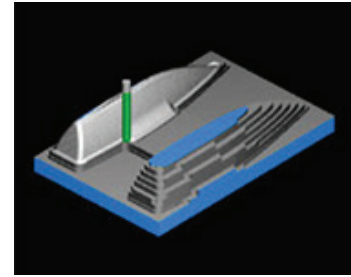
[Source: www.boxford.co.uk, reproduced with permission.]

(a) State a suitable tool that could be used in a CNC router to machine the part shown in Figure C3. *[1]*

(b) Outline how the setting of the machine tool step-over variables will impact on the quality of the surface finish of the part shown in Figure C2. *[2]*

(This question continues on the following page)

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(Question C1 continued)

(c) Discuss the constraints of using a 3-axis machine for manufacturing the boat hull. *[3]*

C2. (a) State a suitable modelling material for a CAM system. *[1]*

(b) Outline **one** benefit of surface modelling techniques for consumers. *[2]*

Turn over

C3. (a) Outline **one** advantage of LOM as part of rapid prototyping. *[2]*

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(b) List **two** benefits of being able to rapid prototype a product. *[2]*

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C4. **Figure C4** shows a gold ring.

Figure C4: CAM gold ring

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

Discuss **two** benefits of using CAM when manufacturing the ring shown in Figure C4. *[6]*

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Turn over

C5. (a) Outline **one** effect of CAM on the workforce of a company wishing to move from traditional to modern manufacturing techniques. *[2]*

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(b) Outline **one** way in which CAM has impacted on the design of kitchen cabinets. *[2]*

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(c) Outline **one** impact of CAD on the nature of the designer-client relationship. *[2]*

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C6. (a)   Compare the use of humans and use of robots in relation to safety in a manufacturing
system.   *[3]*

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(b)   Discuss **one** advantage of using robots for batch production.   *[3]*

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C7. Discuss how the use of Haptic Technology aids the design and use of virtual training in relation to user observation, training and feedback.   *[9]*

Option D — Textiles

D1. **Figure D1** shows a fabric woven from fire retardant fibres. The fabric can withstand temperatures of up to 2000 ˚F. It can be used instead of metal as a protective heat-shield in cars.

Figure D1: Fire retardant fabric

[Source: http://img.tradeindia.com/fp/0/097/908.jpg]

(a) State **one** benefit to the manufacturer of using the fabric shown in Figure D1 in a car. *[1]*

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(b) Outline **one** advantage of the fabric being made by the technique of weaving. *[2]*

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(This question continues on the following page)

(Question D1 continued)

(c)   Explain why the fabric is woven from a fire retardant fibre rather than being treated.   *[3]*

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D2.   (a)   State **one** limitation, apart from cost, to acceptance of wearable computing garments by consumers.   *[1]*

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(b)   Outline **one** way in which a manufacturer could develop a market for wearable computing garments.   *[2]*

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D3. **Figure D2** shows the use of graphic images used on labels for garments.

Figure D2: Garment label symbols

[Source: www.gbnametapes.co.uk/images/woven-washcare.jpg]

(a) Outline **one** advantage to the consumer of the labelling shown in Figure D2. *[2]*

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(b) Outline **one** benefit to the manufacturer of using graphical images on labels. *[2]*

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D4. **Figure D3** shows packaging that is often used for shirts on display in retail stores.

Figure D3: Shirt in packaging

[Source: www.smartfixtures.com/shop/images/catalog/assembly.90301.real.jpg. Used with permission.]

Discuss **two** issues relating to the use of this type of packaging for the display of shirts in retail stores. *[6]*

D5. (a) Outline **one** reason why preserving the cotton industry is important for social sustainability. *[2]*

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(b) Outline **one** environmental issue related to the cultivation of cotton. *[2]*

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(c) Outline **one** impact of quotas on the economics of the cotton industry. *[2]*

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D6. (a) Discuss **one** impact of the maintenance of textiles in the home on health. *[3]*

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(b) Explain **one** way in which improvements in care and maintenance of clothing has had a benefit to the environment. *[3]*

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D7. Explain **three** ways in which textile materials can contribute to the enhanced performance of sportsmen/sportswomen. *[9]*
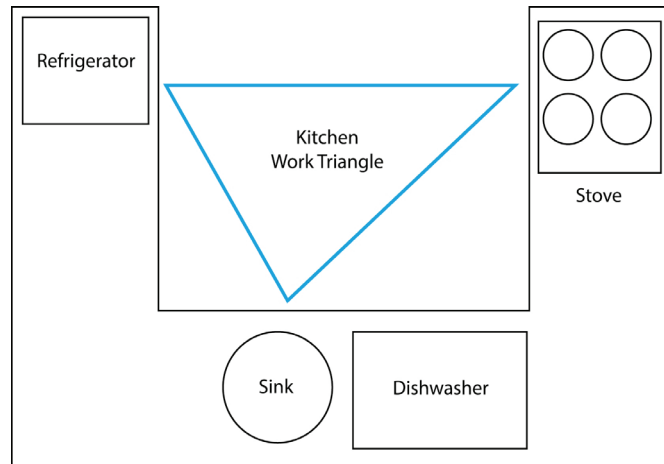
Turn over

Option E — Human factors design

E1. **Figure E1** shows a work triangle for a kitchen.

Figure E1: Kitchen work triangle

[Source: Adapted from: http://en.wikipedia.org/wiki/Kitchen_Work_Triangle]

(a)   State **one** reason for the position of the dishwasher in the kitchen layout.   *[1]*

(b)   Describe the purpose of the use of a kitchen work triangle for the designer.   *[2]*

(Question E1 continued)

(c)　Explain how the work triangle can improve safety for users of the kitchen.　　*[3]*

E2.　(a)　State **one** reason why the lid of a jar is usually fastened tightly at the end of the manufacturing process.　　*[1]*

(b)　Outline **one** bodily tolerance factor involved with unscrewing the lid of a jar.　　*[2]*

Turn over

E3. **Figure E2** shows an instrument used to collect anthropometric data.

Figure E2: Instrument for collecting anthropometric data
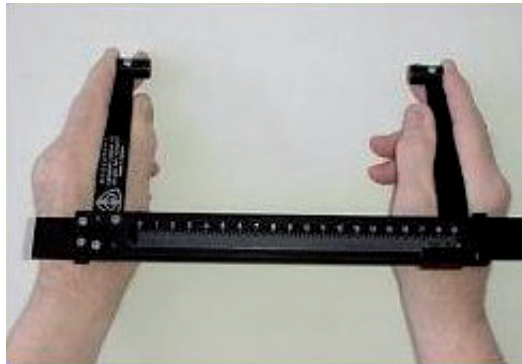
[Source: www.rosscraft.ca. Used with permission.]

(a) Describe the function of the instrument in Figure E2.   *[2]*

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(b) Outline **one** limitation of the use of the instrument in Figure E2 for collecting anthropometric data.   *[2]*

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E4. Discuss how adjustability and range of sizes impact on the global market for clothing. *[6]*

Turn over

E5. (a) Outline **one** reason why the concept of *design for discomfort* may be used in the design of public seating in railway stations. *[2]*

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(b) Outline **one** piece of dynamic human factors data which is important to the designer of public seating. *[2]*

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(c) Outline **one** security issue which has affected the design of seating in airports. *[2]*

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E6. (a) Explain the relationship between user trial and motion capture to the development of a digital human. *[3]*

(b) Explain how the use of digital humans can assist the designer of a car to deal with the problem of designing the car for a wide percentile range. *[3]*

Turn over

E7. Explain why feedback, mapping and affordance are important in human factors design.   *[9]*

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