



22126206



**DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 3**

Wednesday 9 May 2012 (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.
- A calculator is required for this paper.
- The maximum mark for this examination paper is [30 marks].



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Option A — Food science and technology

A1. The shelf life of milk can be extended by being treated in various ways as indicated in **Table A1**. **Figure A1** shows a typical one litre pasteurized milk carton and **Figure A2** shows a collection of individual UHT milk portions.

Figure A1: Carton of pasteurized milk



Figure A2: Individual UHT milk portions



Table A1: Shelf life of milk

Untreated milk	24 hours
Pasteurized milk	5 days
Ultra-Heat treated milk (UHT) (until opened)	6–9 months
Evaporated milk (until opened)	18–24 months
Powdered (dried) milk	24–48 months

(a) State **one** reason why the pasteurization process extends the shelf life of milk. [1]

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(Question A1 continued)

- (b) Outline **one** way in which Ultra-Heat treatment (UHT) affects the organoleptic properties of milk. [2]

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- (c) Explain why powdered (dried) milk has such a long shelf life. [3]

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A2. (a) State the role of protein in the body.

[1]

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(b) List **two** effects of protein deficiency.

[2]

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A3. Pot Noodle (**Figure A3**) is a commercially produced instant snack food containing a dehydrated mixture of noodles, textured soya pieces, dried vegetables and flavouring.

Figure A3: Pot Noodle instant noodle snack food



[http://commons.wikimedia.org/wiki/File:Cupnoodles_seafood_taste.jpgCreated by Wikipedia user Nightshadow28]

(a) Identify **one** reason for the increasing popularity of foods such as Pot Noodle. [2]

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(b) Describe how market testing would be used in the development of the Pot Noodle food product. [2]

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Turn over

Option B — Electronic product design

B1. **Figure B1** shows exterior solar lamps that are used in some gardens. The lamps switch on automatically when it gets dark. **Figure B2** shows the circuit for the exterior solar lamp.

Figure B1: Exterior solar lamp



[Source: <http://en.wikipedia.org/wiki/File:Solarlight.JPG>]

Figure B2: Circuit diagram for exterior solar lamp

Content removed for copyright reasons.

[Please refer to <http://www.sentex.ca/~mec1995/gadgets/741/741.html/> and examine Figure 12 of the 741 Op-Amp Tutorial by Tony Van Roon.

(a) State the name of Component A.

[1]

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(b) Identify the purpose of Component P1 in relation to the exterior solar lamp.

[2]

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(Question B1 continued)

- (c) Explain how the operation of a comparator in the circuit in **Figure B2** influences the type of output saturation. [3]

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- B2.** (a) State **one** advantage of converting a telephone system from analogue signal to digital signal. [1]

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- (b) Outline **one** reason why some telephone systems are still analogue. [2]

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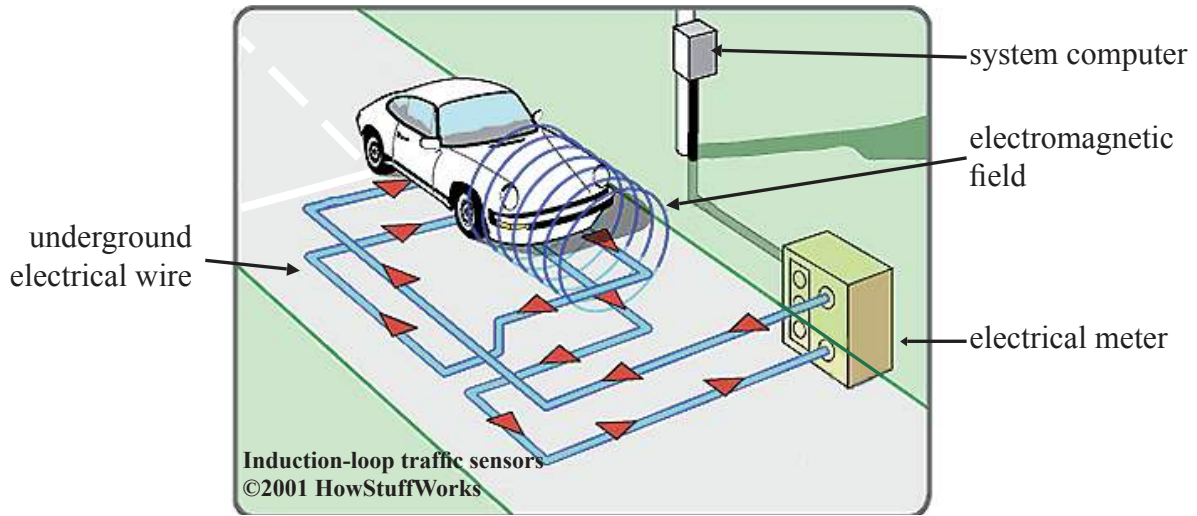
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B3. In rural or suburban environments, traffic lights often use sensors to detect the presence of traffic. **Figure B3** shows an illustration of the relationship of a vehicle to the sensor system.

Figure B3: A traffic light sensor system



[www.howstuffworks.com/enlarge-image.htm?terms=induction+loop+traffic+sensors&page=2; www.howstuffworks.com]

(a) Describe how the system shown in **Figure B3** operates. [2]

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(b) Identify **one** limitation of the use of the underground electrical wire for other road users such as cyclists. [2]

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B4. Outline **one** benefit for the user in purchasing electronic products which are based on generic standards. [2]

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B5. Discuss **two** issues that a communication systems designer would consider when implementing an information transfer system using copper wires. [6]

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Option C — CAD/CAM

C1. **Figure C1** shows a CAD image of the design of a new sign for a Design Technology department. The letters for the sign will be cut from a thermoplastic sheet using a CNC laser cutter (**Figure C2**). Laser cutting is a subtractive process. Initially a prototype of the sign will be cut from thin card.

Figure C1: CAD image of sign

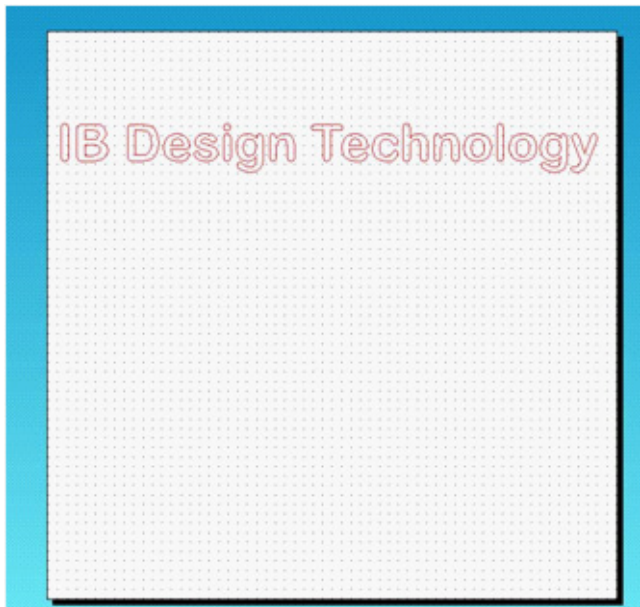


Figure C2: Laser cutter machine



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

(a) State **one** disadvantage of using a subtractive process.

[1]

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(Question C1 continued)

- (b) Outline the settings for the CNC laser cutter that would need to be changed to produce a prototype of the sign from a thin piece of card rather than plastic. [2]

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- (c) Explain **one** advantage of using a laser cutter rather than a CNC router to make the sign in **Figure C1** from a thermoplastic in relation to quality of finish for the lettering. [3]

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C2. (a) State the characteristic of the liquid resin used in stereo lithography that makes it appropriate for 3D printing. [1]

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(b) Outline **one** limitation of rapid prototyping for volume production. [2]

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C3. Figure C3 shows a chair seat made from hardwood shaped using a CNC router.

Figure C3: A chair seat made from hardwood using a CNC router



[encrouting.co.uk. Used with permission.]

- (a) Describe the relationship between the X, Y and Z axis of the CNC router and the manufacture of the part in **Figure C3**. [2]

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- (b) Outline **one** way in which the machine tool step variable will determine the quality of the chair seat shown in **Figure C3** when using a ball nose cutter. [2]

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C4. Outline **one** benefit of using CAD/CAM to create lost wax castings.

[2]

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C5. The Haptic Workstation shown in **Figure C4** is a 3D haptics innovation from Virtual Realities. It is a fully integrated simulation system. **Figure C5** shows a virtual reality image.

Figure C4: Haptic workstation in use



[www.vrealities.com/hapticworkstation.html; Virtual Realities, Ltd.]

Figure C5: Virtual reality image



[Manager Mechanics virtual environment used with permission (www.ManagerMechanics.com).]

Explain **two** differences between haptic technology and virtual reality.

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Option D — Textiles

D1. **Figure D1** and **Figure D2** show two types of acousto-magnetic security tags used by clothes retailers. They are made from two parts, a block and a pin, which are joined magnetically and can only be removed using a magnetic detacher device. The Supertag (**Figure D1**) is 55 mm long. The Unisen Duraltag (**Figure D2**) is 25 mm in diameter.

Figure D1: Supertag



Figure D2: Unisen Duraltag

Content removed for copyright reasons.

[From: http://www.sentecheas.com/products_cat.asp?disp=detail&id=STC1100-2Image of SenTech UltraTag®, used with permission from SenTech]

[Please refer to the Duraltag® image at <http://www.unisen.com/New-Security-Products.html>]

- (a) State **one** reason why retailers might choose to use the Supertag (**Figure D1**) rather than the Unisen Duraltag (**Figure D2**). [1]

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(Question D1 continued)

- (b) Outline **one** reason why the tagging systems shown in **Figure D1** and **Figure D2** are only suitable for a limited range of soft goods. [2]

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- (c) Explain **one** reason why tagging systems as shown in **Figure D1** and **Figure D2** are more popular with large retail outlets such as department stores than small shops. [3]

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D2. **Figure D3** shows a pair of close fitting leggings used by mountaineers as a base layer underneath their outer clothes. The leggings are made from silk.

Figure D3: Close fitting leggings



[<http://www.silkroad88.com/ekmps/shops/silkroadexpre22/silk-thermal-underwear-thermals-for-men-and-women-1-c.asp>]

(a) State **one** characteristic of silk that make it suitable for undergarments for mountaineers. [1]

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(b) Identify the most suitable manufacturing technique for an undergarment made from silk. [2]

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D3. The fabric shown in **Figure D4** has a decorative image woven into it. The fabric has been designed using a CAD program which can convert image files into weave patterns.

Figure D4: Jacquard fabric



[Source: http://commons.wikimedia.org/wiki/File:V%C3%A4v_Daldr%C3%A4ll.jpg]

(a) Outline **one** advantage for the client of using CAD to design the fabric in **Figure D4**. [2]

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(b) Outline **one** issue that the designer must consider when designing the fabric in **Figure D4** for production using CAM. [2]

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D4. Outline **one** advantage of using lace to create underwear.

[2]

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Turn over

D5. Carpets can be treated with a chemical finish to help prevent permanent stains if liquids are spilled (**Figure D5**). This carpet has been treated with chemicals after the carpet has been fitted in the home rather than during manufacture.

Figure D5: Coffee stained carpet



[www.brightoncarpetcleaning.co.uk/Stain-removal-tips.html; Brighton Carpet Cleaning.]

Discuss **two** disadvantages of this method of producing stain resistant carpets.

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D6.

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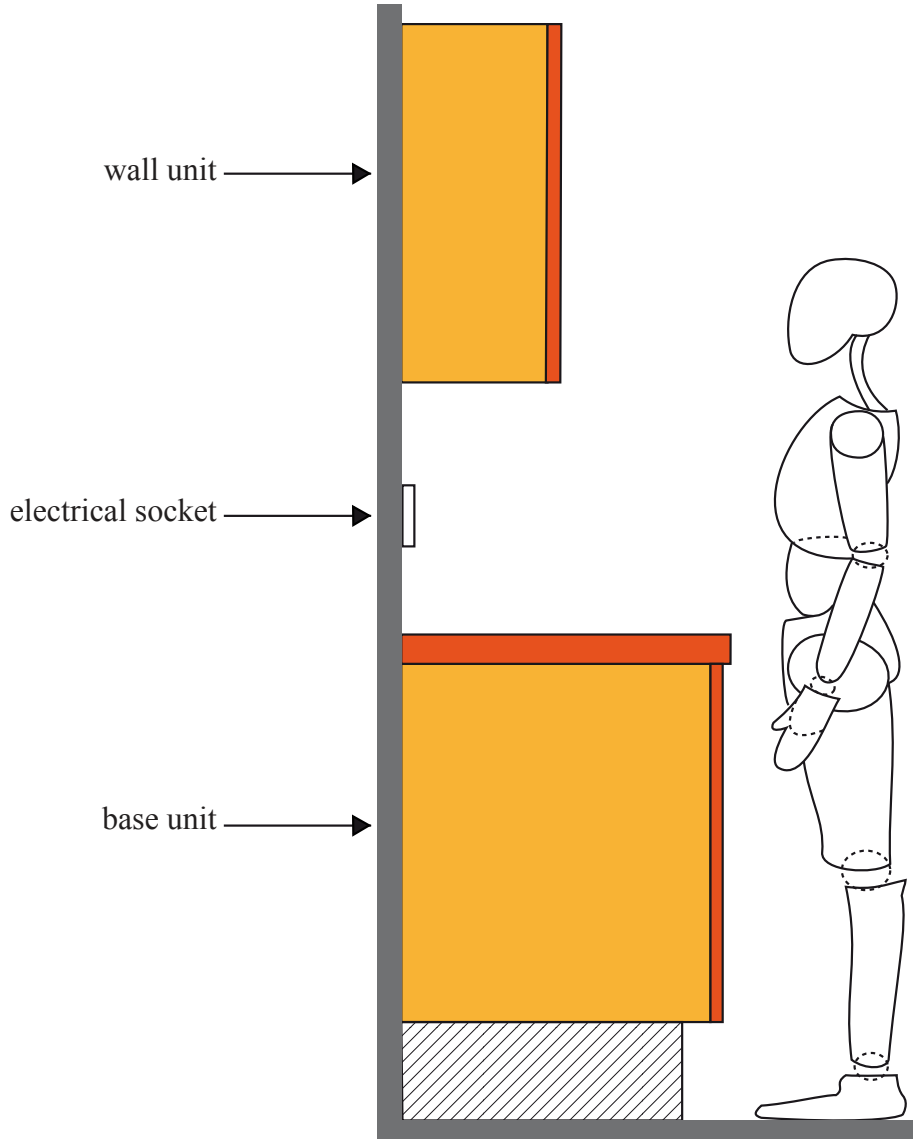
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Turn over

Option E — Human factors design

E1. Figure E1 shows a side view of a standard kitchen unit and an anthropometric model.

Figure E1: Side view of a kitchen unit and an anthropometric model



(a) State the adult percentile which would be used to decide the height of the wall unit. [1]

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(Question E1 continued)

- (b) List **two** pieces of anthropometric data required to determine the depth of the base unit to allow users to gain access to the wall mounted electrical socket. [2]

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- (c) Discuss how the user would make best use of the kitchen units for storage in terms of efficiency and safety. [3]

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E2.

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E3. Figure E3 shows a storage unit for a computer printer used as part of the integrated home office shown in Figure E4.

Figure E3: Printer storage unit



Figure E4: Prima Integrated Home Office



[Strachan Furniture Makers Ltd. Used with permission.]

(a) Describe how the designer has combined ease-of-use with aesthetics for the printer storage unit in **Figure E3**. [2]

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(b) Outline **one** limitation of using the storage unit in relation to bodily tolerance. [2]

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E4. List **two** objectives of annual product testing for electrical equipment.

[2]

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