IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

M04/470/H(3)

DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 3

Candidate number

Wednesday 19 May 2004 (morning)

1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

- Write your candidate number in the box above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from two of the Options in the spaces provided. You may continue your answers on answer sheets. Write your candidate 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 D – Food Technology

D1. Ice cream is produced commercially by blending cream, concentrated skimmed milk or skimmed milk powder, sugar or corn syrup, stabilizers and emulsifiers. The mixture is then pasteurised and homogenized. After standing for at least four hours and usually overnight, the mixture is frozen very quickly in a tubular heat exchanger and aerated by having air whipped in. The mixture is then packaged and blast frozen. **Figure D1** shows a flavour development specialist who tastes ice cream to develop the specifications for new ice cream products. Potential new products are produced in very small quantities and tested with taste panels. Once the specification is confirmed, larger volumes of product can be produced and wider market testing undertaken.

Figure D1: Flavour development specialist

[Source: http://www.outtakes.com/work/taster.html and http://www.benjerry.co.uk]

(a) List **two** organoleptic properties of food. *[2]*

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(b) Explain how taste panels are used in the development of the specification for an ice cream. *[3]*

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D2. Outline how freezing extends the safe storage life of ice cream. *[2]*

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D3. Outline how aeration affects the physical properties of ice cream. *[2]*

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D4. List **two** ways in which food packaging is used as a promotional tool. *[2]*

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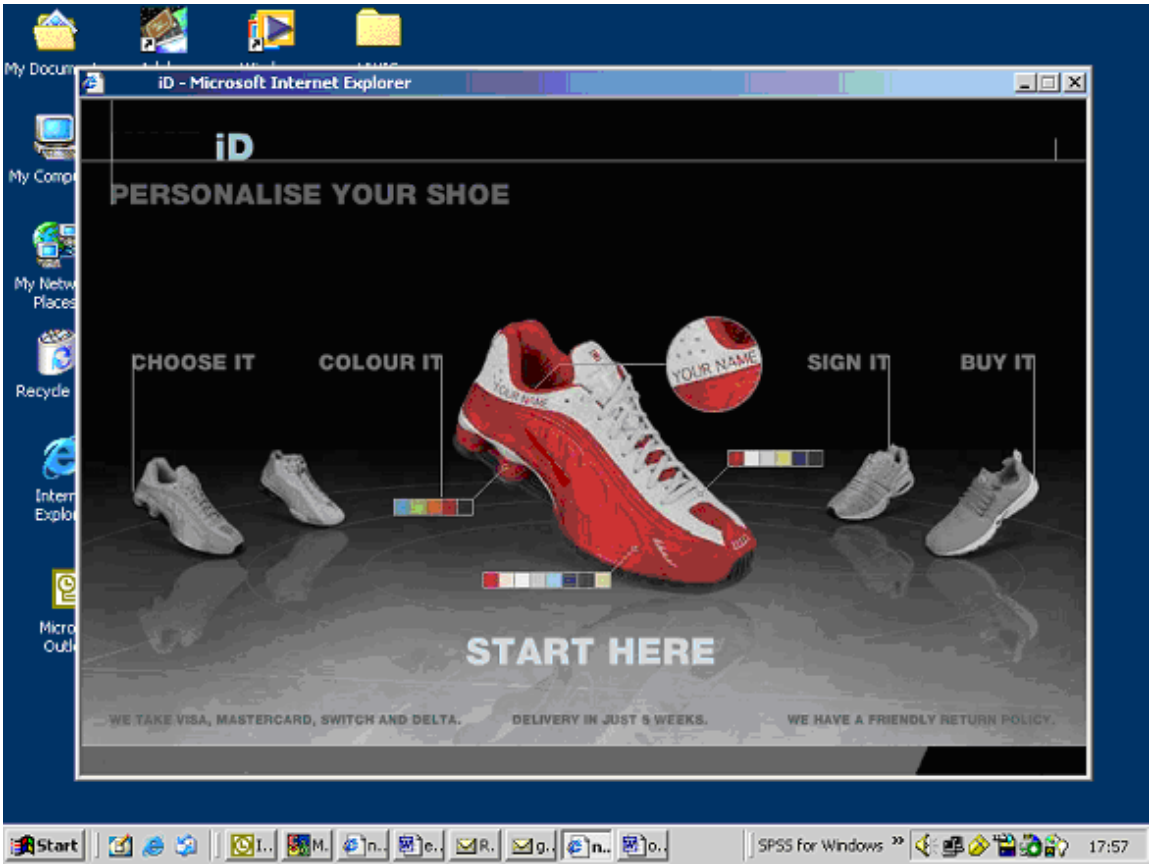
D5. Explain **three** ways in which food poisoning can be avoided. *[9]*

Option E – Computer-aided Design, Manufacture and Production

E1. **Figure E1** shows a screen shot of the home page of a website which enables users to personalise the sports shoes that they are going to purchase. Using the website customers can choose the style of shoe, colour the various parts of the shoe, add their name and complete the purchase.

Figure E1



(a) Define *mass customisation*. *[1]*

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(b) State **one** input device used by customers to customise the design to their own requirements. *[1]*

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(c) Outline how mass customisation transforms the relationship between the manufacturer and the customer. *[2]*

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E2. Explain **one** advantage of Just-in-case (JIC) to manufacturers. *[3]*

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E3. List **two** types of computer software that can be used for modelling. *[2]*

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E4. List **two** strategies that designers could employ for ease of disassembly at the end of a product's useful life. *[2]*

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E5. Explain **three** ways in which the Internet can assist designers with design development. *[9]*

Option F – Invention, Innovation and Design

F1. James Dyson (see **Figure F1**) is an example of an inventor-entrepreneur who has designed some extremely successful products. The original idea for his bagless vacuum cleaner (see **Figure F2**) came to Dyson while he was renovating his house. He spent five years developing the idea and producing a prototype. For two years he looked for someone to license the product. Multinational companies were reluctant to invest in Dyson because of the potential impact on the market for the replacement bags used in traditional vacuum cleaners. Ongoing re-innovation has resulted in a range of cleaners, including a cleaning robot (see **Figure F3**).

Figure F1:

Figure F2:

Figure F3:

[Source: http://www.dyson.co.uk]

(a) Outline **one** reason why Dyson's bagless vacuum cleaner is an example of radical design. *[2]*

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(b) Outline why the cleaning robot shown in Figure F3 is an example of incremental and radical design. *[2]*

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(c) Outline why inventor-entrepreneurs, like Dyson, often have difficulty in obtaining financial support for an invention. *[2]*

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F2. Discuss the implications of adopting a pioneering strategy. *[3]*

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F3. Outline **one** reason why the majority of inventions fail to become innovations. *[2]*

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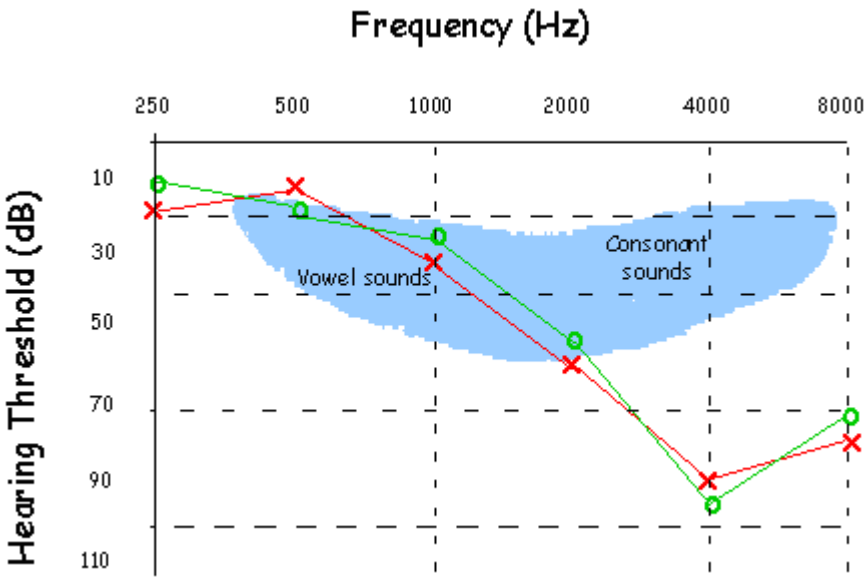
F4. Discuss **three** ways in which global consumerism impacts on local cultures **and/or** communities. *[9]*

Option G – Health by Design

G1. **Figure G1** shows an audiogram, *i.e.*: a graphical representation of the results of a hearing test. The blue shaded region represents the human voice in normal conversation. Every point plotted on the audiogram represents the softest sound the person can hear at each frequency (× for the right ear and o for the left ear) and is called the hearing threshold. Thresholds of 0-25 dB are considered normal. The audiogram shown in **Figure G1** is for an older person who has been working for years in a noisy factory.

Figure G1: Audiogram showing hearing thresholds (× = right ear; o = left ear)



(a) Outline how the hearing of the person whose audiogram is shown in Figure G1 would be affected. *[2]*

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(b) Explain the advantage of a digital hearing aid for the person whose audiogram is shown in Figure G1. *[3]*

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G2. Describe the function of a catalytic converter in a motor car. *[2]*

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G3. Describe **one** advantage of one-day disposable contact lenses. *[2]*

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G4. Outline **one** advantage of user-centred design. *[2]*

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G5. Explain **three** ways in which money spent on ergonomic considerations can prevent repetitive stress injury (RSI) in the workplace and make a return on investment. *[9]*

Option H – Electronic Products

H1. Solar-powered garden lights (see **Figure H1**) are becoming extremely popular – they do not utilise mains electricity, do not require cabling and do not need to be installed by an electrician. The solar lamp comprises a solar cell that recharges a 12-Volt Ni-Cd battery during daylight hours. The battery, when fully charged, can provide sufficient energy to light the lamp for up to eight hours. Using a light-dependent resistor (LDR) with the characteristics as shown in **Table H1** as a light sensor, the light can be designed to turn on automatically at dusk although they can also incorporate a timer to control the time when it turns on. **Figure H2** shows an incomplete circuit for the charging of the cell and the control of the lamp. R1 is 16 kΩ and R2 is 8 kΩ.

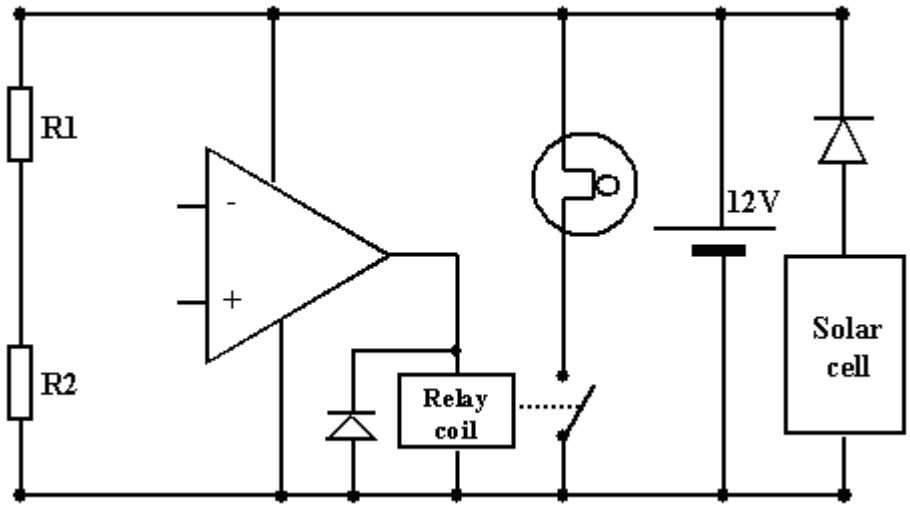
Figure H1: Solar-powered garden light

[Source: http://www.geocities.com/beamcoltd/sindex.html]

Table H1: Characteristics of the LDR

Lighting conditions	Resistance (Ω)
Bright Sunlight	80 Ω
Dusk	12 kΩ
Darkness	1 MΩ

Figure H2: Incomplete circuit for a solar garden light



Note: A relay enables the low current output from an op amp or logic gate to drive a high current load, such as a lamp. The relay contact closes to light the lamp when the output from the op amp is high.

(This question continues on the following page)

(Question H1 continued)

(a) Complete Figure H2, using the LDR and one other resistor (R3 – its value is not required at this stage), so that the operational amplifier operates as a comparator and the light comes on at dusk. *[3]*

(b) Calculate an appropriate value for R3 so that the light comes on at dusk, selecting appropriate values for any other components you include. *[2]*

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(c) Outline how the circuit could be modified to include positive feedback to prevent the lamp switching on and off around the time of dusk due to slight changes in light levels. *[2]*

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H2. Outline how a timer and a digital logic gate would be incorporated into the circuit so that the light will not turn on immediately at dusk but will remain off till after 2100 hours or dusk (whichever is the earlier). *[2]*

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H3. List **two** benefits of using a programmable integrated circuit (PIC) instead of the control circuit designed above for the control of the garden lamp. *[2]*

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H4. Explain **three** ways in which multiplexing can allow many information signals to be sent along the same communication channel. *[9]*