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

N07/4/DESTE/SP3/ENG/TZ0/XX

88076206

DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 3

Thursday 15 November 2007 (morning)

1 hour

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 two 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 — Raw material to final product

A1. Part of a kitchen in a new apartment building is shown in **Figure A1**. Because the kitchen is small, there are plenty of cabinets to help maintain an "un-cluttered" look. The cabinet doors are manufactured from timber, the bench top is made of marble and the sink is produced from stainless steel.

Figure A1: View of kitchen

[Source: www.harbourbreeze.com]

(a) State **two** possible reasons why the glass in the window above the sink, as shown in Figure A1, is not transparent. *[2]*

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(b) Identify **three** properties of particle board which make it an appropriate timber product for use in the doors of the kitchen cabinets as shown in Figure A1. *[3]*

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A2. Describe **one** reason why the surfaces of the timber doors of the kitchen cabinets should be treated. *[2]*

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A3. Outline **one** reason why the sink is made from stainless steel. *[2]*

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A4. Discuss **two** factors which are important in order for the public to accept mycoprotein based new food products and ensure their commercial success. *[6]*

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Option B — Microstructures and macrostructures

B1. **Figure B1** shows workers casting molten iron. An example of a cast iron product, a wheel, is shown in **Figure B2**. The wheel has a polypropene insert in the centre to house the axle. Cast iron wheels are a good choice for heavy loads in warehousing and manufacturing situations where the floors may be uneven or dirty.

Figure B1: Casting molten iron

[Source: www.edinphoto.org.uk © Peter Stubbs.]

Figure B2: Cast iron wheel

[Source: www.cisco-eagle.com. Reproduced with the permission of Cisco-Eagle]

(a) (i) State the type of bonding in the material of the wheel. *[1]*

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(ii) State **one** mechanical property of the cast iron wheel. *[1]*

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(b) State **three** characteristics of polypropene which make it suitable for the centre part of the wheel. *[3]*

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B2. Outline how the grain size in a metal can be determined by the rate of cooling of the metal from the molten state. *[2]*

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B3. Cast iron has a high Young's Modulus. Describe what this means in terms of the wheel in Figure B1. *[2]*

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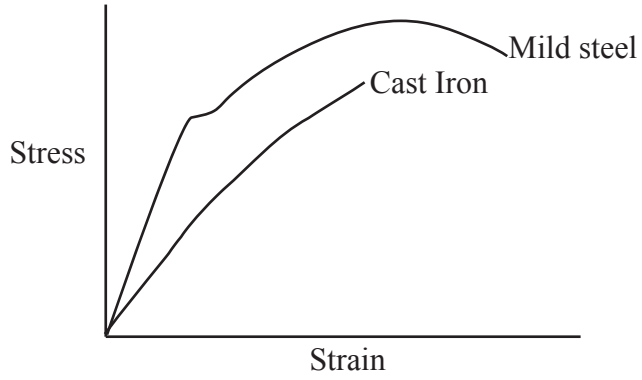
B4. Compare the stress/strain graph for cast iron and mild steel as shown in **Figure B3** below, in terms of the elastic region, plastic region and ultimate stress point. *[6]*
(Notations can be made on Figure B3.)

Figure B3: Stress/Strain graph



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Option C — Appropriate technologies

C1. A house made from rectangular blocks of compressed straw is shown below. **Figure C1** shows the straw bales in position around the frame forming the walls of the house. The straw bales are then coated with a cement mix and painted as shown in **Figure C2**. As a building material, straw is very versatile and inexpensive. The house has no source of heat other than a centrally placed gas stove, and some large south-facing windows.

Figure C1: Straw structure

Figure C2: Finished house

[Source: http://www.i4at.org/lib2/collins1.jpg. Reproduced with the permission of the Institute for Appropriate Technology.]

(a) List **two** characteristics of appropriate technology which apply to the house in Figure C2. *[2]*

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(b) Discuss **one** way in which the straw bale house in Figure C2 helps to conserve the resources of the planet. *[3]*

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C2. Outline **one** possible disadvantage of using straw as a building material. *[2]*

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C3. Distinguish between renewable and non-renewable resources. *[2]*

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C4. Explain how market pull and technology push could contribute toward an increasing number of sustainable houses being built. *[6]*

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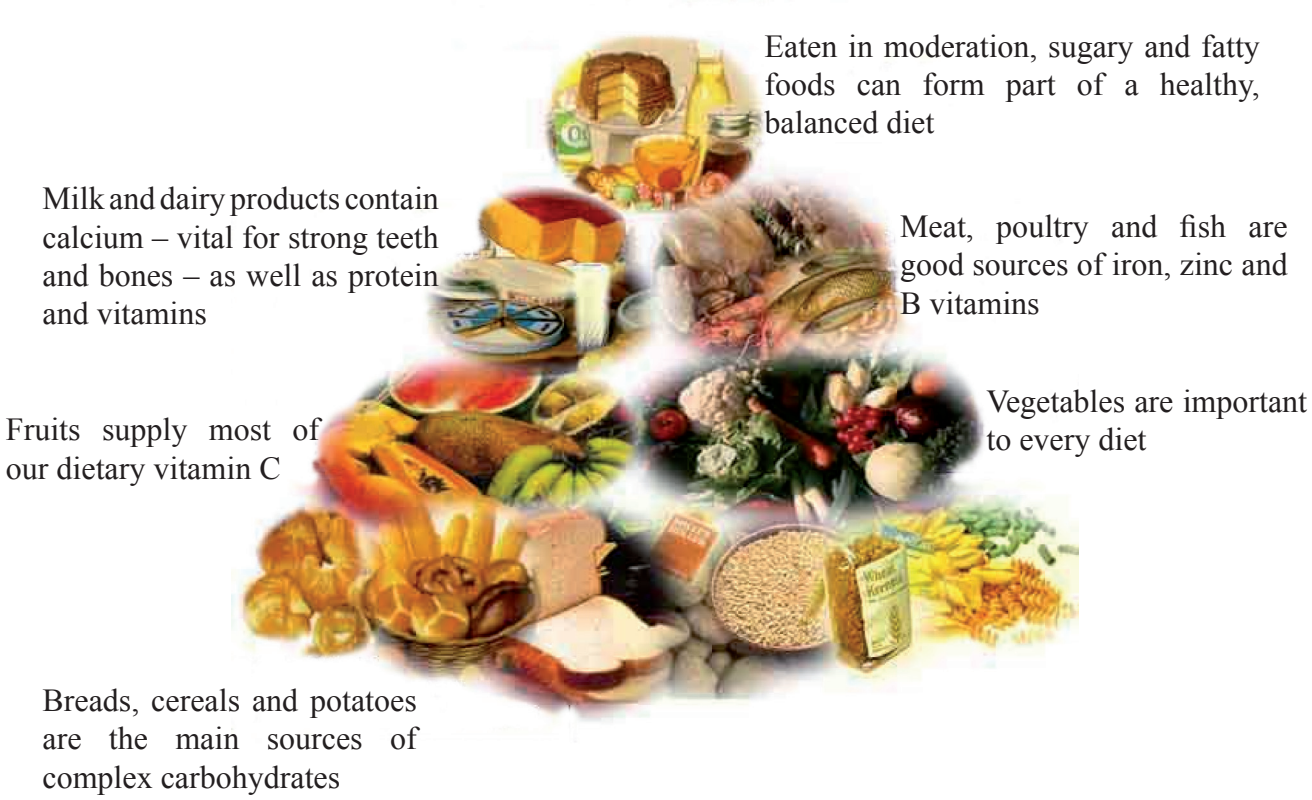
Option D — Food technology

D1. A food pyramid is a common way of representing the food groups required for a balanced diet. A typical example of a food pyramid is shown in **Figure D1**.

Figure D1: Food Pyramid



[Source: http://www.bawarchi.com/health/images/pyramid.jpg]

(a) List **two** foods from the Food Pyramid in Figure D1 which contain macronutrients. *[2]*

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(b) Explain why the food in Figure D1 is organized into the shape of a pyramid. *[3]*

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D2. Select a food from the Pyramid in Figure D1 that is high in fibre and state why fibre is essential for human health. *[2]*

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D3. Describe why apples turn brown when they are cut. *[2]*

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D4. Explain **two** of the principles of microbial food preservation. *[6]*

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Option E — Computer-aided design, manufacture and production

E1. CAD/CAM is used in the design stage as well as for manufacturing. The shapes in **Figure E1** and **Figure E2** have been developed using CAD software. The initial brief for the students was to explore shapes using CAD-CAM and then, from those shapes, develop possible applications for a specific product. After all the components were cut out using a computer-controlled machine, they were then assembled into a 3D model. This activity represented the generating ideas stage in the design cycle. The next stage in the design cycle is to develop a product based on the forms.

Figure E1

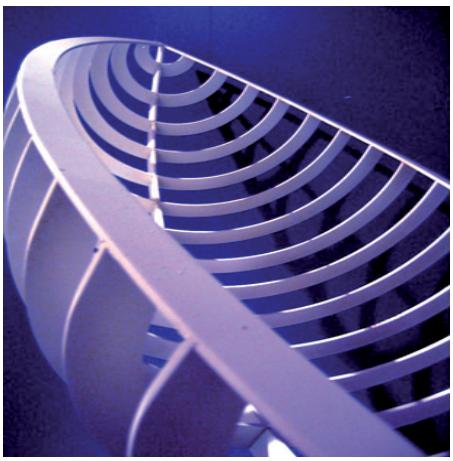
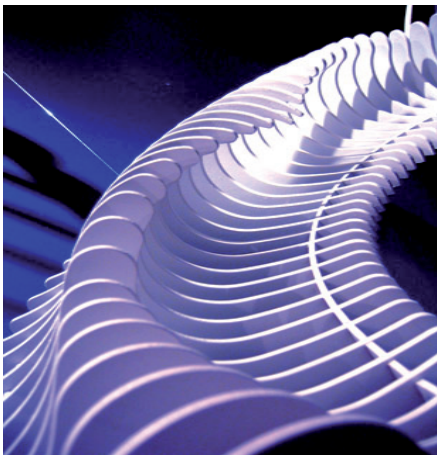


Figure E2



(a) List **three** reasons why designers would choose CAD as a modelling technique to produce the shapes in Figures E1 and E2. *[3]*

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(b) Outline why the shapes in Figures E1 and E2 are best produced by a CNC machine. *[2]*

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E2. Identify why the examples in Figures E1 and E2 are **not** a CIM system. *[2]*

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E3. Identify why production using craft techniques will remain a relevant production process in the future in some situations. *[2]*

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E4. Discuss **two** advantages of mass customization for manufacturers. *[6]*

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Option F — Invention, innovation and design

F1. Oscar Levi Strauss saw the need for tough trousers in the gold rush era of 1849 in California. To respond to the miners' complaints that the knees wore out of traditional trousers he used tent canvas. The fabric was ordered from Nimes in France (de Nimes, or denims). One miner complained that the pockets ripped off too easily when he stuffed his pockets with heavy tools. As a joke, Ike's trousers were taken to a blacksmith and the pockets put back on with rivets. The idea worked so well that Strauss soon put them on all the denim trousers which were called Levi® jeans.

Figure F1: Trousers made from denim

(a) Describe **one** reason why denim jeans as shown in Figure F1 diffused into the market place. *[2]*

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(b) Explain how market pull was the impetus for the development of Levi denim jeans (or trousers) as shown in Figure F1. *[3]*

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F2. Identify **two** examples of incremental design based on the original denim jeans as shown in Figure F1. *[2]*

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F3. Describe the "imitative" corporate strategy of other companies following Levi® jeans pioneering strategy. *[2]*

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F4. Explain **two** criteria why the use of Levi® jeans could be considered to be sound environmentally. *[6]*

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Option G — Health by design

G1. **Figure G1** is an extract from a web site that sells both prescription and non-prescription contact lenses.

Figure G1: Contact lens information

Colour Blend Contact Lenses
These prescriptive soft cosmetic contact lenses can be worn for up to 30 days.

Please note each box contains two lenses of the same power, so if your eyes are different you will need to order a new box for each eye.

Pure Hazel Colour Blends	True Sapphire Colour Blends	Amethyst Colour Blends
NEW COLOUR!	NEW COLOUR!	NEW COLOUR!
		
NEW COLOUR JUST IN!! £20.00	NEW COLOUR JUST IN!! £20.00	NEW COLOUR JUST IN!! £20.00
Prescription: +6.00	Prescription: +0.00	Prescription: −8.00

[Source: http://www.eyechange.co.uk/acatalog/]

(a) Identify **one** advantage of a disposable contact lens as described in Figure G1. *[2]*

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(b) Explain the influence of fashion as it relates to the contact lenses in Figure G1. *[3]*

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G2. Compare soft and hard contact lenses in relation to duration of wear. *[2]*

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G3. Outline why regulatory authorities approve materials for use in medical devices for specific rather than general application. *[2]*

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G4. Discuss **one** advantage and **one** disadvantage of using user-centred design in designing products for disabled people. *[6]*

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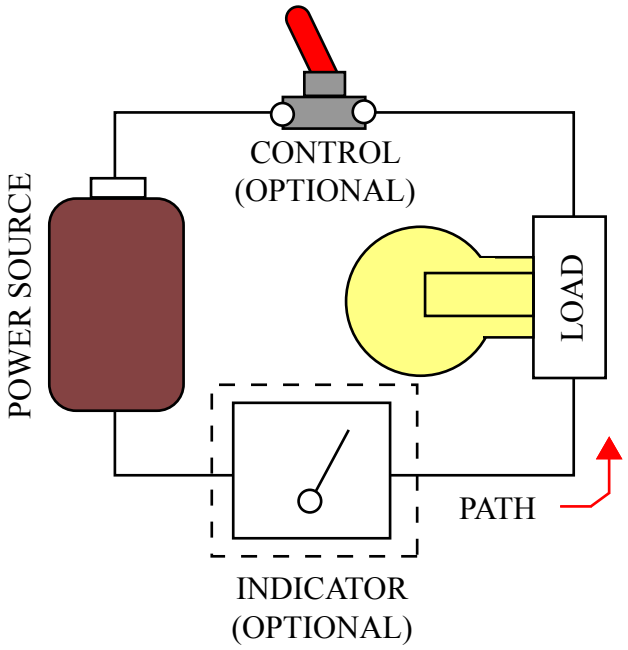
Option H — Electronic products

H1. **Figure H1** shows a very basic generic circuit.

Figure H1: A simple circuit



[Source: http://www.electronics-lab.com/articles/basics/theory/circuit.htm. Copyright John Adams, 1999.]

(a) Draw the International Standard symbols for a normally closed switch and the battery power source. *[2]*

(b) Construct a block diagram and identify the input, process and output components based in Figure H1. *[3]*

H2. Identify how electronic feedback could be used to control a heating system. *[2]*

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H3. Describe the basic function of a semiconductor diode. *[2]*

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H4. Explain **two** benefits of fuzzy logic when it is used in the control of the wash cycle in a washing machine. *[6]*

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