INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

M01/470/S(3)

DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 3

Friday 11 May 2001 (morning)

1 hour 15 minutes

Name

Number

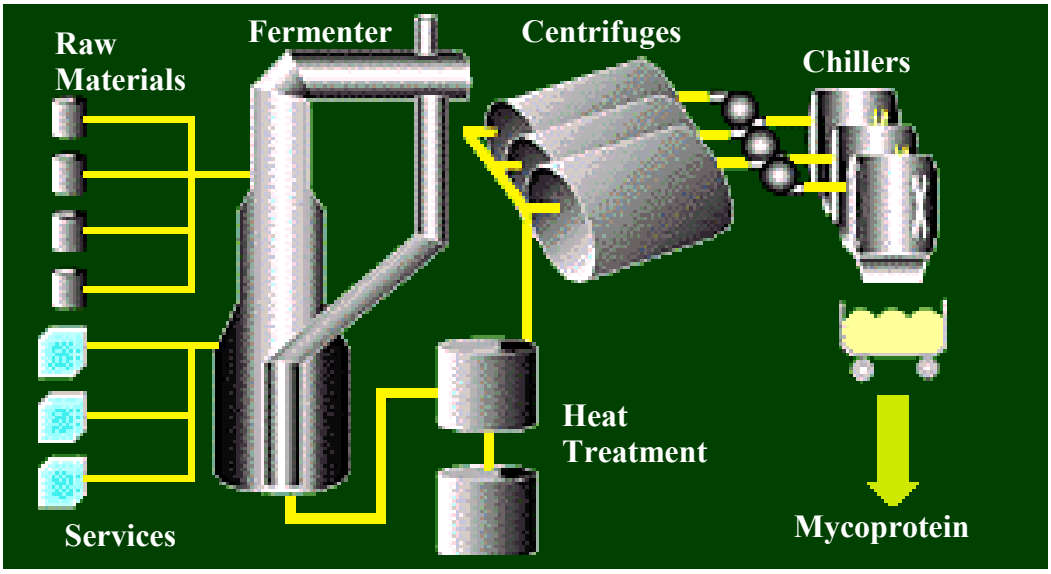
INSTRUCTIONS TO CANDIDATES

- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from three of the Options in the spaces provided. You may continue your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
- At the end of the examination, indicate the letters of the Options answered in the boxes below.

OPTIONS ANSWERED		EXAMINER	TEAM LEADER	IBCA
		/15	/15	/15
		/15	/15	/15
		/15	/15	/15
NUMBER OF CONTINUATION BOOKLETS USED	. . . . .	TOTAL /45	TOTAL /45	TOTAL /45

Option A – Raw material to final product

The diagram below shows the plant used for the fermentation of mycoprotein.



[Source: http://www.quorn.com]

A1. (a) State **one** material which can be used as a substrate for mycoprotein production. *[1]*

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(b) State **one** nutritional advantage of mycoprotein. *[1]*

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(c) Suggest **one** reason why the mycoprotein is heat treated after fermentation. *[2]*

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(d) Outline how mycoprotein can be designed into a range of food products. *[2]*

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A2. Outline the role of coke in the manufacture of iron. *[2]*

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A3. (a) Define *seasoning*. *[1]*

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(b) Outline the need to season natural timber. *[2]*

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A4. Discuss the importance of public acceptability in the commercial success of new food products. *[4]*

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Option B – Products in context

The table below shows the symbols used to classify plastic types and the extent of recycling. The symbols are moulded onto the plastic item.

Symbol	Type	Name (Abbreviation)	Typical Applications	Extent of Recycling
1 PETE	Type 1	Polyethylene Terephthalate (PETE)	Soda and water containers, some waterproof packages.	Commonly recycled.
2 HDPE	Type 2	High Density Polyethylene (HDPE)	Milk, detergent and oil bottles, toys, containers used outdoors, parts and plastic bags.	Commonly recycled.
3 V	Type 3	Vinyl/Polyvinyl Chloride (U/PVC)	Food wrap, vegetable oil bottles, blister packages or automative parts.	Generally not recycled.
4 LDPE	Type 4	Low-Density Polyethylene (LDPE)	Many plastic bags, shrink wrap, garment bags or containers and parts.	Less commonly recycled.
5 PP	Type 5	Polypropylene (PP)	Refrigerated containers, some bags, most bottle tops, some carpets, some food wrap.	Generally not recycled.
6 PS	Type 6	Polystyrene (PS)	Throwaway utensils, meat packing, protective packing.	Generally not recycled.
7 OTHER	Type 7	OTHER	Usually layered or mixed plastic.	Generally not recycled.

B1. (a) State **one** plastic type that is commonly recycled. *[1]*

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(b) State the name of **one** specific plastic that is recycled. *[1]*

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(c) Identify **one** application in which plastics are commonly reused in their original form. *[1]*

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(d) Explain why Type 4 plastics are less commonly recycled. *[2]*

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(e) Outline why Type 7 plastics are generally not recycled. *[2]*

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B2. List **two** characteristics of an appropriate technology. *[2]*

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B3. Describe the difference between a resource and a reserve. *[2]*

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B4. Explain how the development of computer and information technology led to automation. *[4]*

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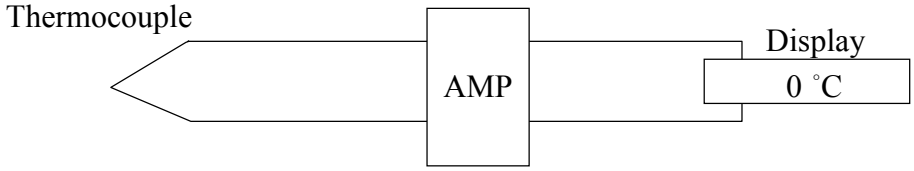
Option C – Mechatronics

Thermocouples are wires of different materials joined mechanically. Heating the junction generates a voltage which can be fed into an amplifier to drive a Liquid Crystal Display (LCD).



The LCD requires a voltage of 0-5 V to give a reading of 0-200 ˚C.

Each thermocouple has a different temperature range and generates a different voltage (per ˚C) as shown in the table

Thermocouple Type	Names of Materials	Useful Application Range	V_{out}
J	Iron (+) Constantan (–)	95 - 760 ˚C	50μV ˚C^{-1}
K	Chromel (+) Alumel (–)	95 - 1260 ˚C	40μV ˚C^{-1}
T	Copper (+) Constantan (–)	–200 - 350 ˚C	40μV ˚C^{-1}
R	Platinum 13% Rhodium (+) Platinum (–)	870 - 1450 ˚C	42μV ˚C^{-1}

C1. (a) Identify a suitable thermocouple type to build a thermometer which can operate across the range 0-200 ˚C. *[1]*

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(b) State the output voltage per ˚C for the thermocouple you have selected. *[1]*

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(c) Calculate the voltage output from your selected thermocouple if it were heated from 0-200 ˚C. *[2]*

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(d) Calculate the gain required to amplify the signal from the answer in (c) to 5 V. *[2]*

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C2. Outline why an alternating current electric motor is used in a hair dryer. *[2]*

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C3. (a) Define *underdamping*. *[1]*

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(b) Draw a diagram to illustrate the importance of critical damping in a position servo-system. *[2]*

C4. Explain why an operational amplifier is suitable for outputting a digital signal from an analogue input or inputs. *[4]*

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Option D – Food technology

Approximately eight hours after a party at which a meal of chicken curry, fried rice and salad followed by ice-cream was served, a number of people were taken ill with diarrhoea.

Symptoms	Approximate time to onset of symptoms	Causative Organism	Growth Temperatures °C	Foods in the meal likely to cause the type of poisoning	Mode of Preparation
Upper gastro-intestinal tract symptoms (nausea, vomiting)	1-6 hrs	*Staphylococcus aureus*	7-45	Chicken curry	- prepared previous day and stored in fridge at 4 °C
Sore throat and respiratory symptoms	12-72 hrs	*Streptococcus pyogenes*	10-45	Salad Ice-cream	- prepared fresh - frozen
Lower gastro-intestinal tract symptoms (abdominal cramps, diarrhoea)	6-12 hrs	*Bacillus cereus*	10-49	Fried rice	- rice boiled and stored overnight at 20 °C before frying and serving
Neurological symptoms (visual disturbances, vertigo, tingling)	2 hrs-6 days (usually 12-36 hrs)	*Clostridium botulinum*	10-50	Chicken curry	- prepared previous day and stored in fridge at 4 °C

[Source: *The Bad Bug Book* http://vm.cfsan.fda.gov/~mow.app2.html]

D1. (a) What symptoms are associated with *Staphylococcus aureus* food poisoning? *[1]*

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(b) What is the approximate time to onset of symptoms for *Clostridium botulinum* food poisoning? *[1]*

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(c) Outline which organism and food is most likely to have caused the illness following the buffet meal. *[2]*

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(d) Explain how you would modify the preparation of the meal to avoid this problem. *[2]*

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D2. Outline the importance of taste panels in the quality control of food products. *[2]*

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D3. (a) Define *gelatinisation*. *[1]*

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(b) Outline how gelatinisation is important in the cooking of food products containing starch. *[2]*

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D4. Explain how the organoleptic properties of food are designed for particular market segments. *[4]*

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Option E – Computer aided design and manufacturing

The image below shows a commercially available, wide field of view, head-mounted virtual reality display system. It has detachable stereo ear phones. The system can be used to overlay video over the user's natural field of vision and provide what is called 'augmented reality'.

[Source: http://www.vrtech.com/products/nvision/datavisorlcd.asp]

E1. (a) Define *virtual reality*. *[1]*

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(b) Outline the benefits of virtual reality applications to consumers. *[2]*

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(c) List **three** ways in which virtual reality helps conserve resources. *[3]*

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E2. Outline the role of spreadsheets in modelling. *[2]*

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E3. (a) Define computer integrated manufacture (CIM). *[1]*

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(b) Outline **one** advantage and **one** disadvantage of CIM to manufacturers. *[2]*

Advantage: . . . . . .

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Disadvantage: . . . . . .

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E4. A garden furniture manufacturer has decided to introduce computer aided manufacturing to replace mechanised techniques. Discuss the implications for the company. *[4]*

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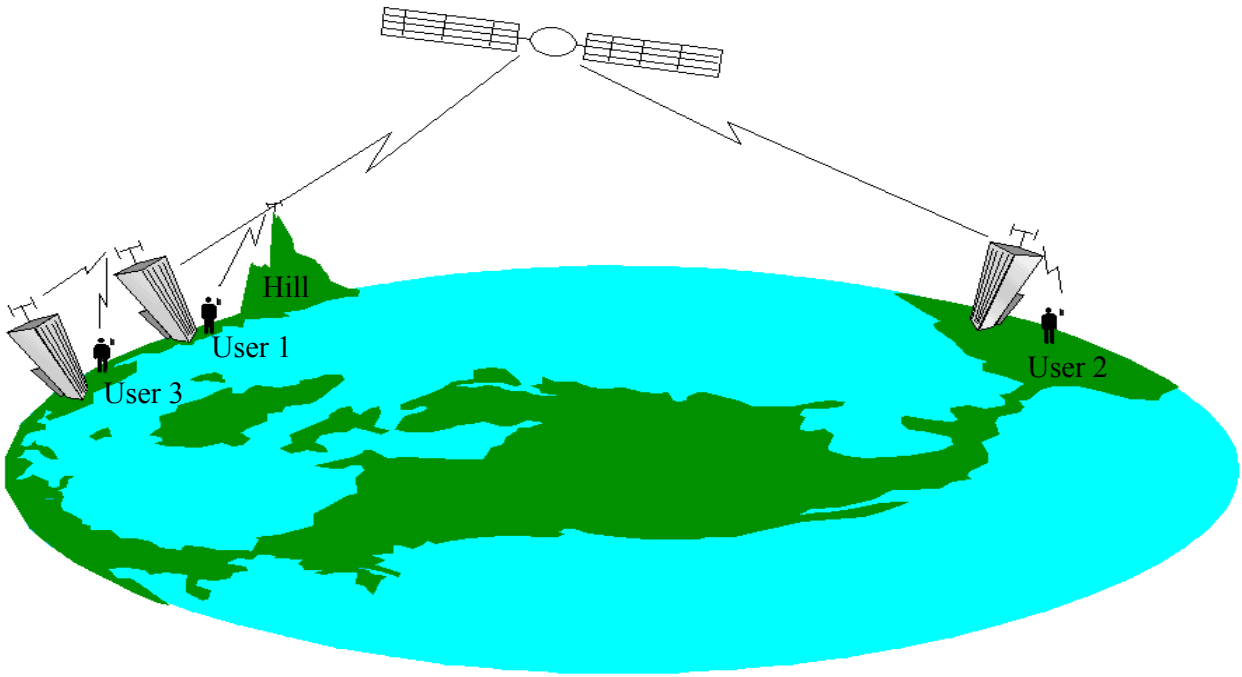
Option F – Invention, innovation and design

In August 1999 two major satellite phone companies went bankrupt despite one company having launched 66 satellites and both companies having invested billions of dollars in the development. The satellite phone companies had underestimated the rapid expansion of land-based mobile phone systems. By the time the satellite systems were operational cell phone towers had been built along highways and on the top of buildings around the world. Compared with cell phones, handsets for satellite phones require larger power packs so the handsets are much more bulky, they are much more expensive to buy and the wavelengths they use mean that the phones do not work unless they have line-of-sight connection with the orbiting satellites.



F1. (a) State why user 3's satellite phone does not work. *[1]*

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(b) Outline why there will never be world-wide coverage by cell phones. *[2]*

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(c) State **one** application where a satellite phone system would be an appropriate solution. *[1]*

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(d) Explain the impact of socio-economic need on the failure of the satellite phone. *[2]*

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F2. Outline how gears have been important in the development of the bicycle. *[2]*

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F3. (a) Define *invention*. *[1]*

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(b) Draw a simple model to describe the innovation process. *[2]*

F4. Explain the role of technology push and market pull in the innovation process. *[4]*

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Option G – Health by design

Figure 1 shows a cross-section through a human eye. Figure 2 illustrates an optical defect. Figure 3 shows two lenses, A and B.

Figure 1

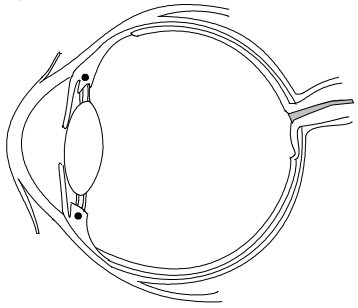


Figure 2

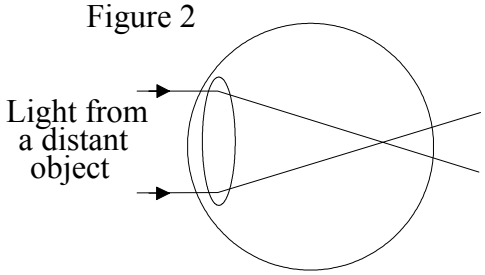
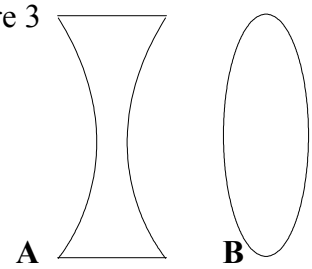


Figure 3



G1. (a) Identify the optical defect illustrated in Figure 2. *[1]*

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(b) Which of the lenses shown in figure 3 would be used to correct the optical defect illustrated in Figure 2? *[1]*

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(c) Outline how the lens corrects the optical defect. *[2]*

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(d) Explain how high refractive index glass benefits spectacle wearers. *[2]*

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G2. Outline **one** way in which Magnetic Resonance Imaging (MRI) is superior to Computer Tomography (CT) scanning. *[2]*

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G3. State **one** disadvantage of a metal/glass hypodermic syringe and needle. *[1]*

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G4. Identify **two** performance characteristics for a medical thermometer. *[2]*

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G5. Discuss the impact of diabetic testing sticks on the lives of diabetics. *[4]*

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