



22076206

**DESIGN TECHNOLOGY  
STANDARD LEVEL  
PAPER 3**

Friday 11 May 2007 (morning)

1 hour

Candidate session number

0	0							
---	---	--	--	--	--	--	--	--

**INSTRUCTIONS TO CANDIDATES**

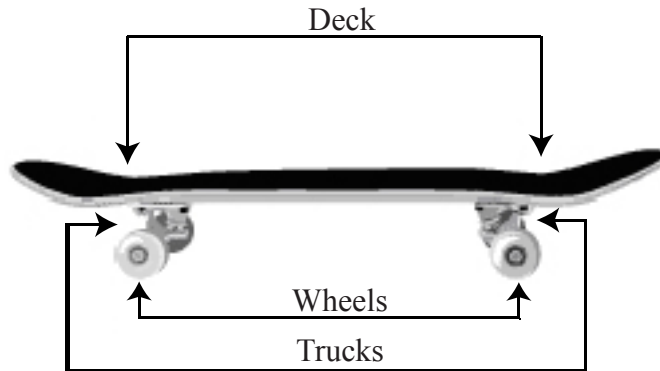
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from two of the Options in the spaces provided. You may continue your answers on answer sheets. Write your session number on each answer sheet, and attach them 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.** Skateboarding is a popular leisure activity and competitive sport. Skateboard decks (see **Figures A1 and A2**) are often made from layers of Maple (a Canadian hardwood). The wheels are made from nylon and are fixed to the trucks which in turn are fixed to the deck. The wheels need to be firm for some sporting environments and softer for others.

**Figure A1: View of one side of a skateboard**



**Figure A2: A skateboarder in competition**



(a) Outline **one** characteristic of hardwoods that makes them appropriate for the construction of the deck of a skateboard, such as in Figure A1. [2]

.....  
.....  
.....  
.....

*(This question continues on the following page)*



*(Question A1 continued)*

- (b) Explain why a laminated construction rather than solid wood is used to produce the deck of the skateboard in Figure A1 and A2. [3]

.....  
.....  
.....  
.....

- A2.** Describe why nylon can be used for both firm and soft skateboard wheel requirements. [2]

.....  
.....  
.....  
.....

- A3.** Outline **one** reason why stainless steel would be a more appropriate material than mild steel for the manufacture of the skateboard trucks in Figure A1. [2]

.....  
.....  
.....  
.....



**A4.** Discuss **two** advantages of adding scrap glass to the manufacturing process of glass. [6]

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....



Blank page



**Option B — Microstructures and macrostructures**

**B1.** The creation and manufacture of quality jewellery requires a good understanding of the structures of materials. **Figure B1** shows a diamond, held in place by four clips and a thermoset adhesive, in a 14 carat gold ring. Gold is a soft material and so it is alloyed to produce the material for the ring.

**Figure B1: A diamond ring**



(a) Describe the structure of a diamond crystal such as in Figure B1. [2]

.....  
.....  
.....  
.....

(b) Explain why diamond is a very hard material. [3]

.....  
.....  
.....  
.....

**B2.** Describe why a thermoset adhesive would be appropriate to fix the diamond to the ring. [2]

.....  
.....  
.....



**B3.** Outline **one** physical property of gold which is affected by alloying, and makes it more appropriate for use in a ring. [2]

.....  
.....  
.....

**B4.** Discuss **two** composite materials in terms of their evolution over time. [6]

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....



**Option C — Appropriate technologies**

**C1.** **Figure C1** shows a designer using his pedal powered mechanical drill. It is a standard drill which has been linked to the driving wheel on an exercise bike. It was designed so people who exercise could use their energy for a purpose.

**Figure C1: Pedal operated drill**



[Source: CCAT Pedal-powered Mechanical Drill press;  
[www.humboldt.edu/~ccat/pedalpower/inventions/frames\\_final\\_htm.htm](http://www.humboldt.edu/~ccat/pedalpower/inventions/frames_final_htm.htm)]

(a) Describe why the pedal-powered drill in Figure C1 is an alternative technology. [2]

.....  
.....  
.....

(b) Discuss **one** context in which the pedal-powered drill in Figure C1 would be an appropriate technology. [3]

.....  
.....  
.....





C2. Describe why pedal power is a form of renewable energy. [2]

.....  
.....  
.....  
.....

C3. Outline **one** way a manufacturer could use energy in a way which is consistent with sustainable development. [2]

.....  
.....  
.....  
.....

C4. Discuss **two** barriers to recycling paper. [6]

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....



**Option D — Food technology**

**D1.** **Figure D1** shows a range of bread and pastry products. Bread is a staple food widely used around the world, produced domestically and commercially. Sourdough is a type of bread that involves a long fermentation process.

**Table D1: Nutrition Facts for Sourdough Bread**

**Figure D1: A range of bread and pastry products**

Nutrition Facts for Sourdough Bread		
(48 g serve)	Amount	% daily intake
Fat	0 g	0
Cholesterol	0 mg	0
Sodium	170 mg	7
Carbohydrate	23 g	8
Fiber	1 g	4
Sugars	1 g	
Protein	1 g	
Vitamin A		0
Calcium		0
Iron		6



[Source: www.scottsbakery.com/]

(a) List the primary **and** secondary processes involved in making bread. [2]

.....

.....

.....

(b) Outline **one** organoleptic property of bread. [2]

.....

.....

.....

**D2.** List **one** macronutrient and **one** micronutrient from the content of the sourdough bread in Table D1. [2]

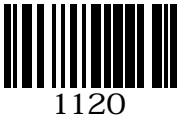
.....  
.....  
.....  
.....

**D3.** Explain **one** other piece of information that could be included on a food label for bread, apart from nutritional information. [3]

.....  
.....  
.....  
.....

**D4.** Explain what is meant by a balanced diet, and list **three** ways in which bread can contribute to that balance. [6]

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....



**Option E — Computer-aided design, manufacture and production**

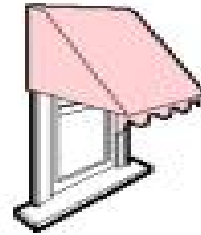
**E1.** The computer controlled machine in **Figure E1** is used to cut thermoplastic coated textiles for external window shades. Cutting is done by up to five ultrasound cutters.

**Figure E1: CNC cutting machine**



[Source: www.jentschmann.ch/ PAC2000-E.htm]

**Figure E2: External window shade**



(a) Describe how CAD and CNC systems work together to produce the CAD/CAM system in Figure E1. [2]

.....  
.....  
.....

(b) Discuss **one** advantage of using the CNC machines to cut textiles. [3]

.....  
.....  
.....  
.....  
.....

**E2.** Compare **one** aspect of CNC cutting with traditional craft cutting. [2]

.....  
.....  
.....  
.....

**E3.** Describe how a CNC machine could contribute to a JIT approach to manufacturing. [2]

.....

.....

.....

.....

**E4.** Discuss **two** changes for consumers as a result of mass customization. [6]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



**Option F — Invention, innovation and design**

**F1.** **Figure F1** shows a digital camera docked into a picture printer. The pictures can be viewed on the camera and then deleted, saved or printed by docking the camera onto the top of the printer. The printer will produce prints by inkjet rather than using chemicals. Prints can be generated from memory cards or wirelessly from a mobile phone, and the camera battery can be charged when it is docked.

**Figure F1: Digital camera and printer**



(a) List **two** possible aspects of the camera-printer in Figure F1 which make it attractive for market diffusion. [2]

.....  
.....  
.....

(b) Explain **one** reason why the camera-printer in Figure F1 would have been unlikely to have been invented by a lone inventor. [3]

.....  
.....  
.....  
.....  
.....



**F2.** Outline **one** benefit of being a pioneer in relation to the manufacture of the camera-printer in Figure F1. [2]

.....  
.....  
.....

**F3.** Describe **one** way in which the printing process of the innovative camera-printer in Figure F1 helps safeguard the environment. [2]

.....  
.....  
.....  
.....

**F4.** Discuss **one** technological and **one** social development that was important in the development of the bicycle. [6]

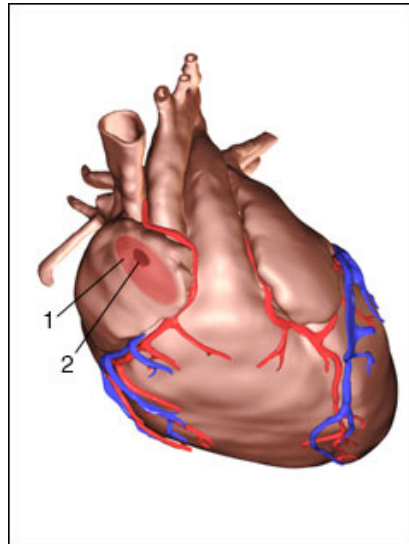
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....



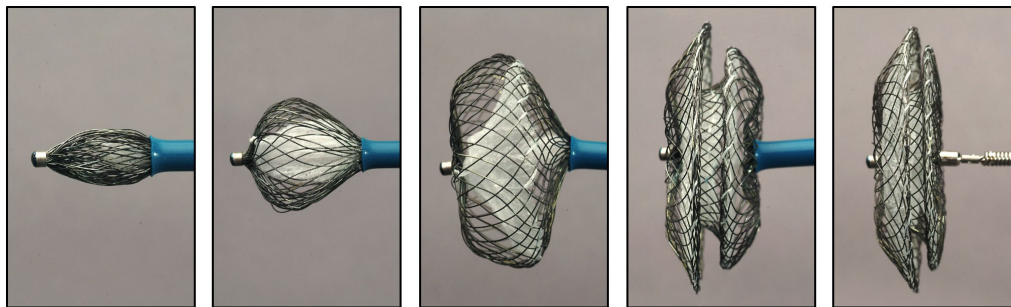
**Option G — Health by design**

**G1.** Small holes in the heart (**Figure G1**) can be treated using a small umbrella like device called a CardioSEAL® (**Figure G2**). The device is folded into a thin tube, inserted in a vein, and moved into the hole in the heart. The device is then pushed out of the tube, allowing the small umbrella to open and cover each side of the hole. The tube is then removed. The fabric in the device is Dacron® and the metal alloy is nitinol (nickel and titanium alloy).

**Figure G1: 1. Atrial Wall 2. Opening in the Atrial Wall**



**Figure G2: The sequence of the device being pushed out of the tube**



(a) Define *biocompatibility*. [1]

.....  
.....

(b) State **one** material commonly used for implants in the human body. [1]

.....  
.....

*(This question continues on the following page)*





*(Question G1 continued)*

- (c) Explain how the material used in the CardioSEAL® would have been tested for use as an implant. [3]

.....  
.....  
.....  
.....  
.....

- G2. Describe how spectacle wearers have benefited from the development of high refractive index glass. [2]

.....  
.....  
.....  
.....

- G3. Identify **one** way user-centred design plays a role in the development of wheelchairs. [2]

.....  
.....  
.....  
.....



**G4.** Explain **one** effect of exhaust gases from motor vehicles on people and **one** effect on the environment.

[6]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

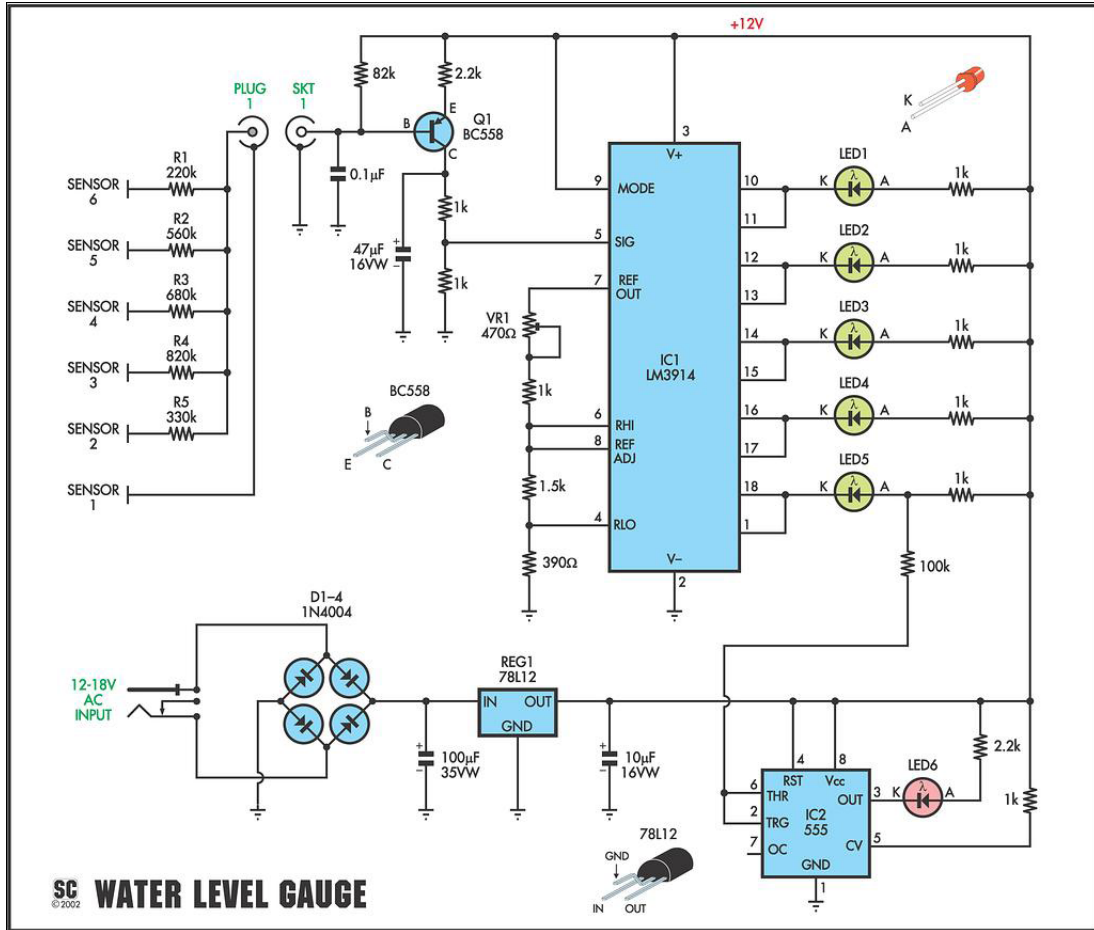
.....



Option H — Electronic products

H1. Figure H1 shows an electrical circuit for a domestic product.

Figure H1



(a) State the regulated power supplied to the circuit in Figure H1. [1]

.....

(b) Describe the function of the sub system associated with the IC2-555. [2]

.....

.....

.....

.....

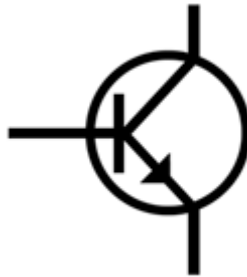


**H2.** The LM3914 is an integrated circuit that senses analogue voltage levels. Explain how the circuit in Figure H1 functions. [3]

.....  
.....  
.....  
.....

**H3.** Annotate the diagram in Figure H2 to indicate the base, emitter, and the collector. [3]

**Figure H2**



**H4.** Discuss **two** impacts on society of the miniaturisation of electronic products. [6]

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....