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DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 2

Candidate session number

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Friday 9 November 2012 (afternoon)

1 hour

Examination code

8	8	1	2	–	6	2	0	5

INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[40 marks]*.

SECTION A

*Answer **all** questions. Write your answers in the boxes provided.*

1. **Figure 1** shows Nomura bank's new London office. The building has been designed with many sustainable features (see **Table 1**) including rain water collection on the roof which feeds a filtration tank in the basement. The London office caters for 3000 people, with most working on the bottom four floors of the eleven floor building. Nomura bank is a global company which has offices in many countries around the world.

Figure 1: Nomura's London Headquarters

[Source: ©Nomura/Fletcher Priest Architects. Used with permission.]

Table 1: Data relating to sustainable features

- 40 % reduction in electricity use saving £2 million per year.
- 1.4 km of LED (light-emitting diode) lighting instead of a conventional system with light bulbs, saving £78 000 per year.
- A new more efficient IT system has reduced the annual electricity bill by £6.7 million for all of the bank's global offices resulting in a 44 % reduction in energy use.
- Filtered rainwater collected from the roof is used to flush the toilets on the bottom four floors (where most staff work) saving 39 million litres of water per year (25 % of total consumption) and £28 000 per year.
- 2.5 km of pipes carry cold water through 1000 staff desks to keep computers cool and reduce the cost of air conditioning.
- Desk bins have been replaced with one recycling station per 100 staff with an estimated reduction of 8000 bin bags of rubbish to landfill per year.
- Moss on the roof absorbs Carbon and insulates the building.

(This question continues on the following page)

(Question 1 continued)

(a) (i) State the total amount of the annual electricity bill for the building shown in Figure 1. *[1]*

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(ii) State how many litres of water are consumed in the building each year. *[1]*

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(iii) Outline **one** reason why the water cooling system is limited to 1000 desks. *[2]*

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(This question continues on the following page)

(Question 1 continued)

(b) (i) Outline **one** reason why the system for using rainwater may not be suitable for all of the company's offices worldwide. *[2]*

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(ii) Outline **one** reason why the rainwater used for flushing toilets needs to be filtered. *[2]*

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(c) (i) State the number of recycling stations required. *[1]*

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(ii) Suggest **one** reason for limiting the system of rainwater use for flushing toilets to the bottom four floors of the building (other than the number of staff on each floor). *[3]*

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2. (a) Define *fixed costs*. *[1]*

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(b) Explain the concept of the *break-even* point in relation to fixed and variable costs. *[3]*

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3. (a) Describe what is meant by grain size in relation to metals. *[2]*

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(b) Describe how the tensile strength of a metal is increased by alloying. *[2]*

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SECTION B

*Answer **one** question. Write your answers in the boxes provided.*

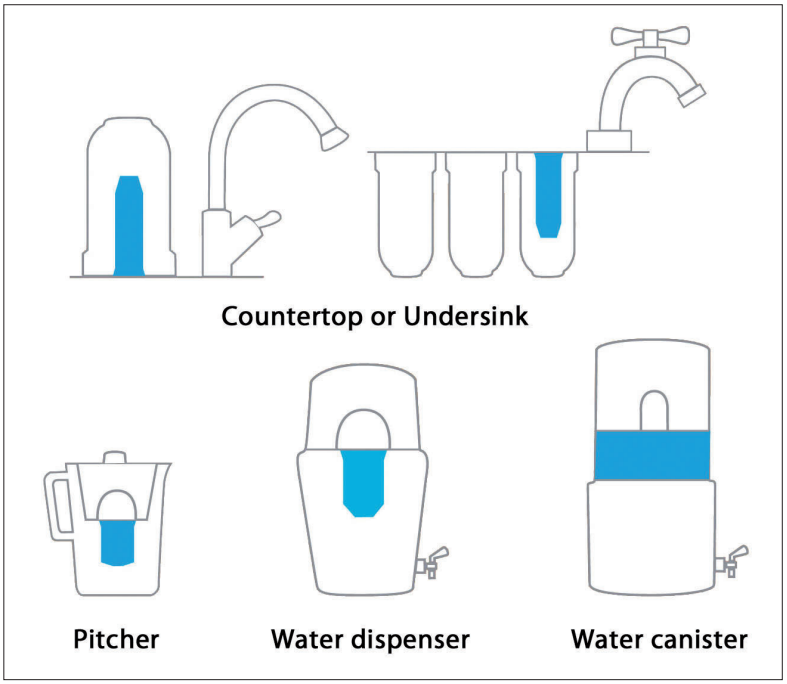
4. HaloPure cartridges contain a contact-biocide technology in which halogen atoms are bonded onto thermoplastic beads. As harmful microbes pass through the HaloPure cartridge, they collide with the halogen atoms and are killed in a matter of seconds (see **Figure 2**) so treated water is purified and disinfected quickly. HaloPure BR has been tested against a wide range of microbes. All HaloPure products meet the World Health Organization guidelines for safety and disinfection. Perfecting the process took more than 10 years with $60 million invested by a number of stakeholders.

HaloPure promises include:

- technology that is effective against bacteria and viruses
- high performance in highly variable water conditions
- a flexible and unique range of devices and applications (see **Figure 3**)
- test-proven products in key world markets
- products capable of withstanding heavy use.

Figure 2: HaloPure – how it works

Figure 3: HaloPure Point of use Cartridge Technology Applications



[Source: www.halopure.com. Used with permission.]

(This question continues on the following page)

(Question 4 continued)

(a) (i) State the type of bonding for the thermoplastic used to manufacture the beads. *[1]*

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(ii) Outline the molecular structure of a thermoplastic. *[2]*

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(iii) Outline the scale of production for the plastic beads. *[2]*

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(This question continues on the following page)

(Question 4 continued)

(b) (i) State the evaluation strategy used for a prototype of the cartridge. *[1]*

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(ii) Suggest **one** reason why the Research and Development costs for the HaloPure system are so high. *[3]*

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(Question 4 continued)

(c) (i) Outline **one** benefit of using *design for disassembly* for the design of the cartridge. *[2]*

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(ii) Discuss **three** potential limitations of the HaloPure water purification system for use by people in developing countries. *[9]*

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5. **Figure 4** shows the *Gtech* SW02 cordless floor cleaner. The cleaner was originally patented by Nick Grey in 2002 after he had spent a year of research and development during which time he produced many models and prototypes to test on friends and family. Grey used £20 000 of his savings to develop the floor cleaner which was manufactured in China and eventually launched onto the market in the US under the name *Shark Sweeper*. The product was an immediate success and then in 2003 was sold in the UK under the company name *Gtech*. Over 20 million sweepers have since been sold and Grey (who still owns 100 % of the company) has invented other products such as a lightweight hedge trimmer. The floor cleaner is suitable for all floor types; has a telescopic handle and runs for 60 minutes before it needs re-charging for 16 hours.

Figure 4: *Gtech* SW02 cordless floor cleaner

[Source: www.gtechonline.co.uk. Used with permission.]

(a) (i) State **one** advantage of the cleaner having a telescopic handle. *[1]*

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(This question continues on the following page)

(Question 5 continued)

(ii) Outline **one** possible reason for naming the floor cleaner *Shark Sweeper* in the US. *[2]*

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(iii) Outline **one** possible reason why the floor cleaner was named *Gtech* when launched in the UK. *[2]*

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(This question continues on the following page)

(Question 5 continued)

(b) (i) State **one** disadvantage of the floor cleaner being cordless. *[1]*

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(ii) Compare the use of models with the use of prototypes to develop the floor cleaner. *[3]*

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(Question 5 continued)

(c) (i) Outline the corporate strategy used by *Gtech* since 2003. *[2]*

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(ii) Explain why Nick Grey may be considered an inventor, innovator and entrepreneur. *[9]*

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6. **Figure 5** shows the SPLAT Child's chair designed by Spinifex. The chair is designed for creative youngsters who like to paint and draw. Compartments in the back hold art materials while paper is stored under the seat. It is also ideal for holding games and small toys. It is made from laminated cardboard sheets threaded on postal tubes (see **Figure 6**). The chair is biodegradable, it is recommended for ages 3–6 years and has dimensions 50 cm × 30 cm × 50 cm. Each chair is made to order.

Figure 5: SPLAT Child's chair

[Source: www.mimimyne.com/splat-recycledcardboard-childs-chair-p-85.html]

Figure 6: Postal tubes

[Source: Used with the permission of Holmes Mann & Co Ltd. www.holman.co.uk]

(a) (i) State **one** aspect of the SPLAT Child's chair's manufacture which conforms to just-in-time (JIT) production. *[1]*

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(ii) Outline the SPLAT Child's chair in relation to radical and incremental design. *[2]*

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(Question 6 continued)

(iii) Outline **one** reason for producing the SPLAT Child's chair in a range of colours for the seat only, rather than the entire chair. *[2]*

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(b) (i) Define *quality control*. *[1]*

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(ii) Explain how the strategy *design for materials* has been a dominant constraint in the design brief for the SPLAT Child's chair. *[3]*

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(Question 6 continued)

(c) (i) Outline the design of the SPLAT Child's chair in relation to planned obsolescence. *[2]*

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(ii) Discuss **three** factors relating to ease-of-use for the SPLAT Child's chair. *[9]*

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