



22136205



**DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 2**

Thursday 16 May 2013 (afternoon)

1 hour

Candidate session number

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Examination code

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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.
- 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].



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SECTION A

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

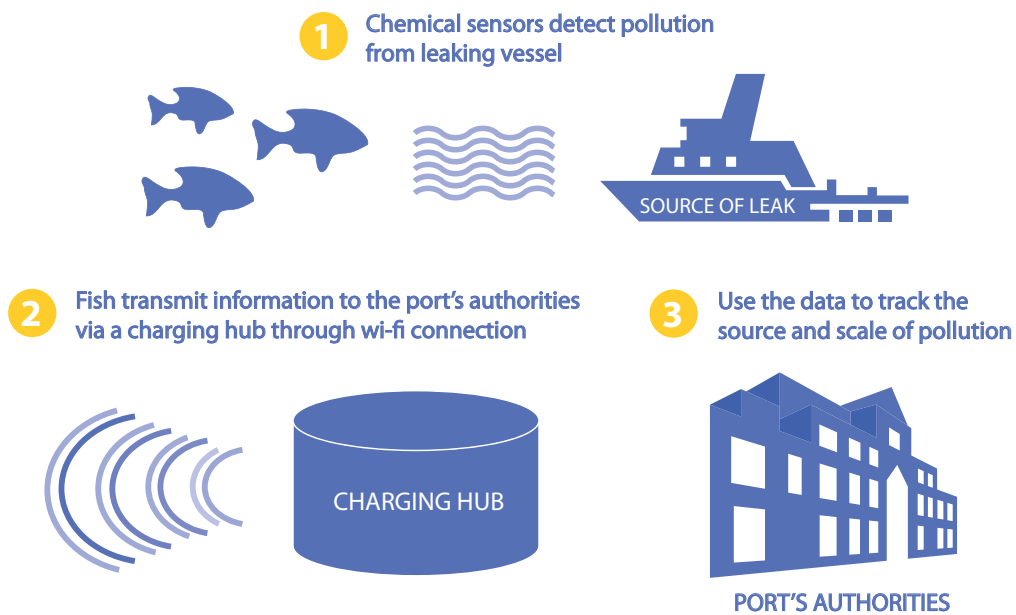
1. **Figure 1** shows a robotic fish developed by scientists at the University of Essex (UK) and BMT Group LTD (UK) as part of a three year research project co-funded by the European Commission. The robotic fish mimic the undulating movements of real fish and are equipped with tiny chemical sensors to find the source of potentially damaging pollutants in rivers, lakes and seas such as leaks in oil pipes and water quality monitoring. The fish will return to an offshore recharging station each day to upload information on pollutants in the water which will enable the authorities to map the source and scale of the pollution as depicted in **Figure 2**. The robotic fish are made from a polymer-metal composite and have been tested in the London Aquarium for a two year period as part of the design development process. **Table 1** shows some of the specifications for the robotic fish.

Figure 1: Robotic fish



[Source: UPPA. Used with permission.]

Figure 2: Communication process for the robotic fish



[Source: Source: BMT Group Ltd. Used with permission.]

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(Question 1 continued)

Table 1: Specifications for the robotic fish

Avoid obstacles
Find source of pollution
Monitor pollution
Maintain communication with other robotic fish
Maintain communication distance from other sea creatures
Recharge themselves daily at the charging station
8 hour (approx) battery life before recharge
Adapt quickly to a rapidly changing environment
Work as an individual and as a team
Approximate cost of each fish – £20 000
Length of fish = 1.5 m (5 ft)
1 m/s max speed
3 motion control methods – cruising, manoeuvring, hovering

[Source: Source: BMT Group Ltd. Used with permission.]

- (a) (i) State the evaluation strategy used at the London Aquarium. [1]

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- (ii) State **one** reason why the test at the London Aquarium was done over a two-year period. [1]

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(Question 1 continued)

- (iii) Outline **one** limitation of relying on the data generated from the London Aquarium evaluation. [2]

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- (b) (i) Outline **one** limitation of the use of the robotic fish for data gathering. [2]

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- (ii) Outline a potential hazard to the robotic fish when used in the ocean. [2]

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(Question 1 continued)

- (c) (i) State **one** reason why the robotic fish are designed to resemble real fish. [1]

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- (ii) Explain why it was necessary to develop a new composite material for the manufacture of the robotic fish. [3]

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2. (a) State the symbol used in a flow chart to represent a decision. [1]

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- (b) Explain why producing a prototype is a form of modelling. [3]

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3. (a) State what is meant by physiological factors as part of ergonomics. [1]

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- (b) Explain the relationship of quantitative and qualitative data to the concept of perception when considering ergonomics. [3]

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SECTION B

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

- 4. **Figure 3** shows the Odin chair which is part of the Nordic (Scandinavian) range of furniture and is manufactured in central China. The chair is made from plywood and steel with a chrome finish. The plywood is veneered with a hardwood (beech or walnut). The seat and the backrest are joined to the tubular steel frame with fasteners.

Figure 3: Odin chair



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

- (a) (i) Identify the percentile which would be used to decide on the height of the chair seat. [2]

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(Question 4 continued)

- (ii) Outline **one** limitation of the chair when it is used for sitting on for long periods of time. [2]

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- (b) (i) Outline the importance of ductility to the choice of material for the frame of chair. [2]

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- (ii) Suggest **one** reason why the chair is manufactured in China. [3]

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5. **Figure 4** shows the Freeplay wind-up flashlight (torch). 30 seconds of winding powers a battery which produces 20 minutes of light. A fully-charged battery produces 20 hours of light. The Freeplay flashlight is available in a choice of three bright colours. The company Freeplay is well known for its range of wind-up devices.

Figure 4: Freeplay wind-up flashlight (torch)



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

- (a) (i) Outline **one** market segment for the flashlight based on consumer attitudes to green design. [2]

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- (ii) Outline **one** limitation of the flashlight in relation to product life. [2]

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(Question 5 continued)

- (b) (i) Outline **one** reason apart from aesthetics for producing the flashlight in bright colours. [2]

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- (ii) Suggest **one** reason for designing the flashlight with a transparent body in relation to style. [3]

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- (c) (i) Outline **one** disadvantage of the flashlight when stored in a backpack during hiking. [2]

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6. **Figure 5** shows the Minima office bottle and can crusher manufactured by Redit. The outer casing is made from a thermoplastic material. Inside the casing, metal plates are powered by an electric motor to crush plastic bottles and steel or aluminium cans to 20% of their original size. The crushed cans/bottles then drop into a plastic bag. The crusher is operated by pressing a button on the top surface which also has a digital screen to show how much carbon might have been saved each time it is used.

Figure 5: Minima Office Bottle/Can Crusher



[Source: www.minima-eco.com/howitworks. Used with permission.]

- (a) (i) Outline how the ideas generating technique of adaptation has been used in the design of the crusher. [2]

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(Question 6 continued)

- (ii) Outline **one** reason for the choice of colour scheme for the crusher. [2]

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- (b) (i) Outline **one** maintenance issue for the crusher relating to hygiene. [2]

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- (ii) Discuss **one** disadvantage in purchasing the Minima for a company employing over 500 people working in a multi-storey building. [3]

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Answers written on this page
will not be marked.



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