

**DESIGN TECHNOLOGY  
STANDARD LEVEL  
PAPER 2**

Candidate number

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Wednesday 14 May 2003 (afternoon)

1 hour

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**INSTRUCTIONS TO CANDIDATES**

- Write your candidate number in the box above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer one question from Section B. Write your answers on answer sheets. Write your candidate 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 numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

### SECTION A

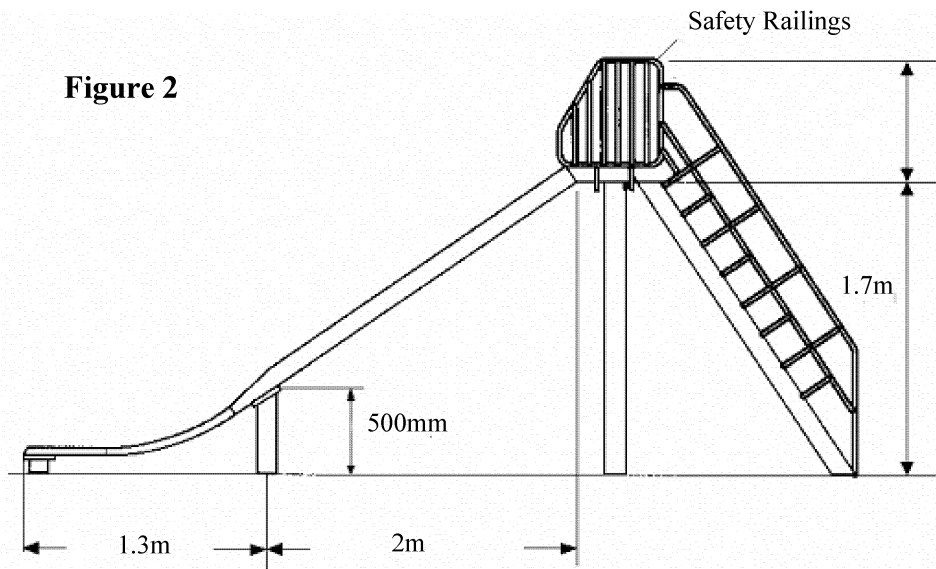
Answer **all** the questions in the spaces provided.

1. Safety is a key consideration in the design of children's playgrounds. One aspect of safety relates to the nature of play surfaces. A child falling from a height, *e.g.* a slide (see **Figure 1** and **Figure 2**), can sustain broken bones and head injuries. Various materials, *e.g.* chopped tree bark or tiles made from recycled rubber car tyres, can be used to absorb impact and minimize injuries. One manufacturer supplies four different thickness tiles - thicker tiles are used where children can fall from greater heights (see **Table 1**). The tiles are 500 mm by 500 mm squares and are glued onto a concrete base that is laid onto a compacted stone base on firm sub-soil (see **Figure 3**). Care needs to be taken in the preparation of the compacted stone base to ensure that it is flat and that the correct final level will be achieved when the concrete base and the tiles are laid on.

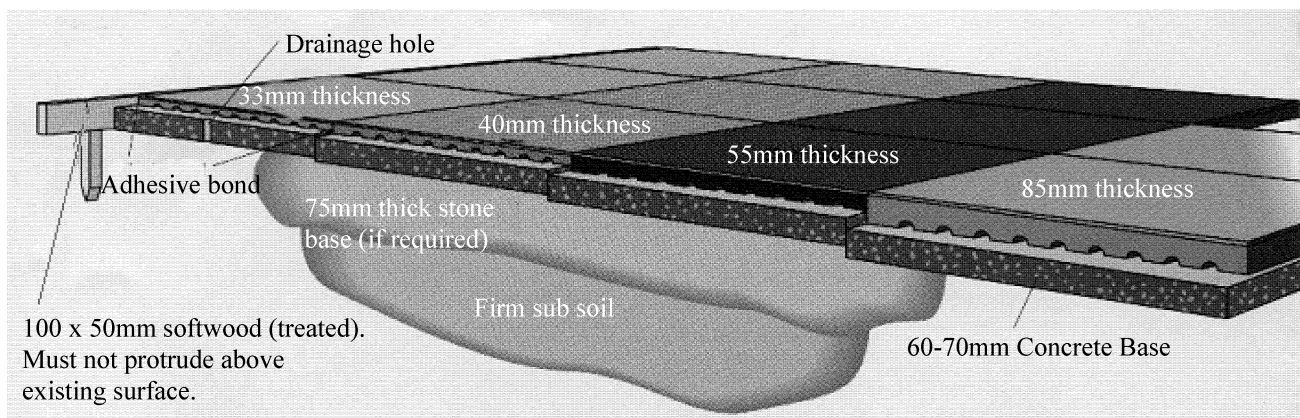
**Figure 1**



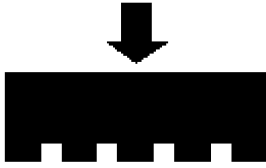
**Figure 2**



**Figure 3**



**Table 1**

	Tile number	Tile 1	Tile 2	Tile 3	Tile 4
	Tile thickness (mm)	33	40	55	85
	Recommended maximum safe height of fall (m)	1.2	1.4	2.0	2.6
	Cost per tile (\$)	80	120	160	200

(a) (i) State **one** advantage of using tiles rather than chopped bark for the play surface in the childrens' playground. [1]

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(ii) State the least thickness of tile that could be safely used for the play surface at the lower end of the slide. [1]

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(iii) Calculate the maximum height from which a child could fall whilst using the slide. [2]

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The designer is evaluating two options for tiling the playground - one option uses thinner tiles around the bottom of the slide and thicker tiles elsewhere, the other uses thicker tiles across the whole area.

(b) (i) State **one** advantage of using a combination of thinner and thicker tiles rather than thicker tiles alone. [1]

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(ii) Explain why the option of using just thicker tiles for the whole area rather than a combination of thinner and thicker tiles enables a flat play surface to be constructed more easily. [3]

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*(This question continues on the following page)*

*(Question 1 continued)*

- (c) (i) Outline **one** appropriate strategy to evaluate the maximum safe height of fall onto the tiles. [2]

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- (ii) List **two** disadvantages of using this strategy to collect data in this design context. [2]

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2. Safety railings can be produced from metal tubing. Metal tubing of different square and circular cross sections can be produced by extrusion.

- (a) State **one** advantage of extrusion for the production of metal tubing. [1]

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- (b) Explain how safety railings would be produced from metal tubing. [3]

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3. (a) Define *automated guided vehicle (AGV)*. [1]

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(b) Explain how AGVs can contribute to an automated production system. [3]

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### SECTION B

Answer **one** question. Write your answers on the answer sheets provided. Write your candidate number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.

4. **Figure 4** shows two plastic planters that have been volume produced by injection moulding.

**Figure 4**



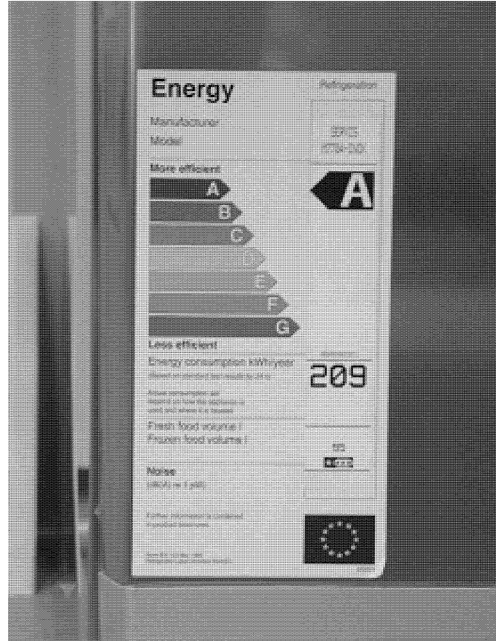
- (a) (i) Define *volume production*. [1]
- (ii) Identify how one-off production contributes to the volume production of the plastic planter by injection moulding. [2]
- (iii) Outline **one** relevant property of a material that makes it suitable for injection moulding. [2]
- (b) (i) State **one** fixed cost and **one** variable cost in the manufacture of the plastic planter. [2]
- (ii) Outline how fixed and variable costs contribute to the final cost of the plastic planter. [2]
- (c) (i) Outline **one** way in which injection moulding can be considered as a clean technology. [2]
- (ii) Explain how the environmental impact of the plastic planter can be minimized at the production, distribution and disposal stages of its life cycle. [9]

5. Consumers are faced with a bewildering array of options when contemplating the purchase of kitchen appliances, e.g. refrigerators. Fashion and planned obsolescence ensure a continuing market for new refrigerators. **Figure 5** shows a refrigerator and **Figure 6** shows its energy label.

**Figure 5**



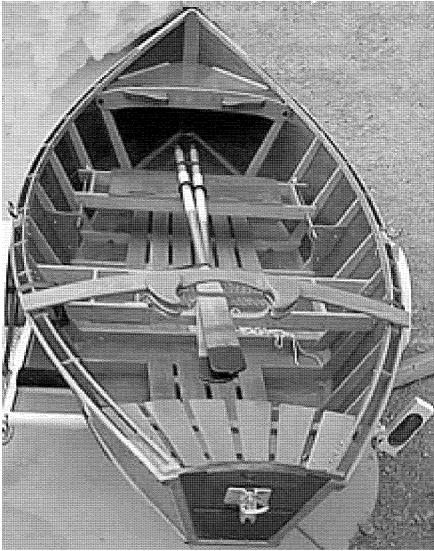
**Figure 6**



- (a) (i) Define *value for money*. [1]
- (ii) List **two** criteria that could be used to evaluate the refrigerator in terms of value for money. [2]
- (iii) Outline **one** reason why the refrigerator can be considered as in the mature stage of its product life cycle. [2]
- (b) (i) Outline **one** way in which thermal conductivity of the insulation material in the casing of the refrigerator contributes to the energy efficiency of the refrigerator. [2]
- (ii) Identify **one** potential source of thermal conductivity data for designers. [2]
- (c) (i) Outline how energy-labelling schemes can help consumers compare potential purchases. [2]
- (ii) Discuss the implications of fashion and planned obsolescence for natural resources, waste and pollution. [9]

6. A boat-building company has traditionally manufactured wooden boats (see **Figure 7**) using mechanized techniques. Recently the company has decided to diversify and has started to manufacture boats in a traditional style using a composite material (see **Figure 8**).

**Figure 7**



**Figure 8**



- (a) (i) Outline how aesthetic considerations affect the design of products. [2]
- (ii) Outline why the design for the boat made of composite materials is a combination of incremental and radical design. [2]
- (b) (i) Define *batch production*. [1]
- (ii) Outline **one** advantage of mechanization for the production of the boats. [2]
- (iii) Outline **one** impact of the new design on the manufacturing process. [2]
- (c) (i) Outline why composite materials cannot be easily recycled. [2]
- (ii) Explain how the strategies for green design of repair and recycle can be applied to the two boats. [9]



