IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

M05/4/DESTE/HP2/ENG/TZ0/XX+

22056202

DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 2

Wednesday 4 May 2005 (afternoon)

1 hour 45 minutes

Candidate session number

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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 of Section A in the spaces provided.
- Section B: answer one question from Section B. Write 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 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.

0110

SECTION A

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

1. Internal doors in houses are often seen as fashion items and may be replaced several times during the life of a house. There are various types of door including panel door construction (see **Figure 1**) and hollow door construction (see **Figure 2**). The stile and rails of a panel door would be made of solid timber and the infill panels may be timber or glass. Hollow doors are made using a hidden frame for which the top and bottom rails and stiles are made with a softwood timber baton covered down two sides only by a ¼ inch thick solid timber decorative strip. A hollow door has a cardboard honeycomb infill and is clad with a thin skin of particleboard or plywood. Doors come in standard sizes (height 78, 80 or 84 inches; width 24, 27, 30, 32, 34 or 36 inches). They can be trimmed to fit door frames that are up to ¼ inch less or up to 5/8 inch greater. The door would be hung on hinges (see **Table 1**) – one hinge is fitted for every 30 inches of door height. Hinges can have a loose pin (see **Figure 3(a)**) or fixed pin design (see **Figure 3(b)**).

Figure 1: Panel door construction

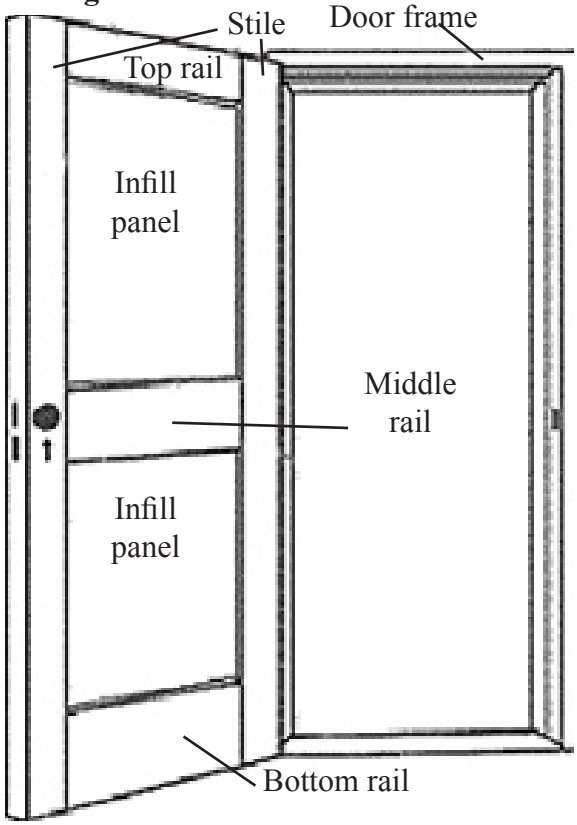

Figure 2: Hollow door construction

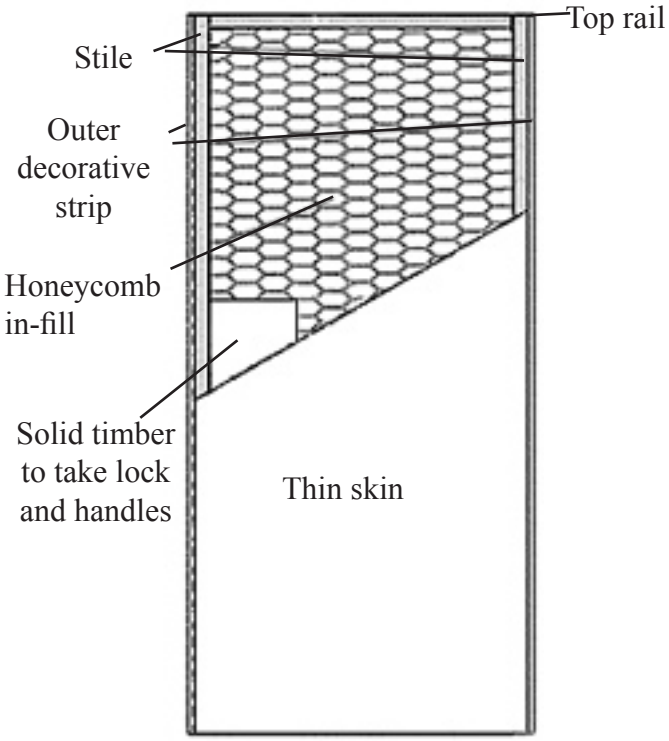

Table 1: Door width and hinge specification

Door width	Hinge size
up to 32 inches	3½ inches
32-37 inches	4 inches
37-43 inches	5 inches

Figure 3: Butt hinges

(a) loose pin

(b) fixed pin

(This question continues on the following page)

(Question 1 continued)

(a) (i) State the range of heights of door frame (in inches) that an 80-inch high door would fit. *[1]*

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(ii) State how many hinges would be required to hang an 80-inch high door. *[1]*

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(iii) Which size of hinge would be used for hanging an 80-inch high and 36-inch wide door? *[1]*

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(b) (i) List **two** advantages of using cardboard for the honeycomb infill for the hollow door. *[2]*

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(ii) Calculate the length of 1.5-inch square section softwood timber baton in inches that would be required to make the top rail of an 80-inch high and 36-inch wide hollow frame door (as in Figure 2). *[2]*

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(c) (i) List **two** advantages of using plywood for the cladding of the door. *[2]*

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(ii) Suggest **one** advantage of using a loose pin hinge for hanging the door? *[3]*

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(Question 1 continued)

A homeowner is going to stain and varnish a plywood-clad hollow door. **Figure 4** is a flow chart representing the process of staining and varnishing of timber. **Table 2** shows data for a range of timber treatments and varnishes. The total surface area of the door (including sides and edges) to be coated is 3.9 m^2.

Figure 4: Flow chart for the staining and varnishing of timber

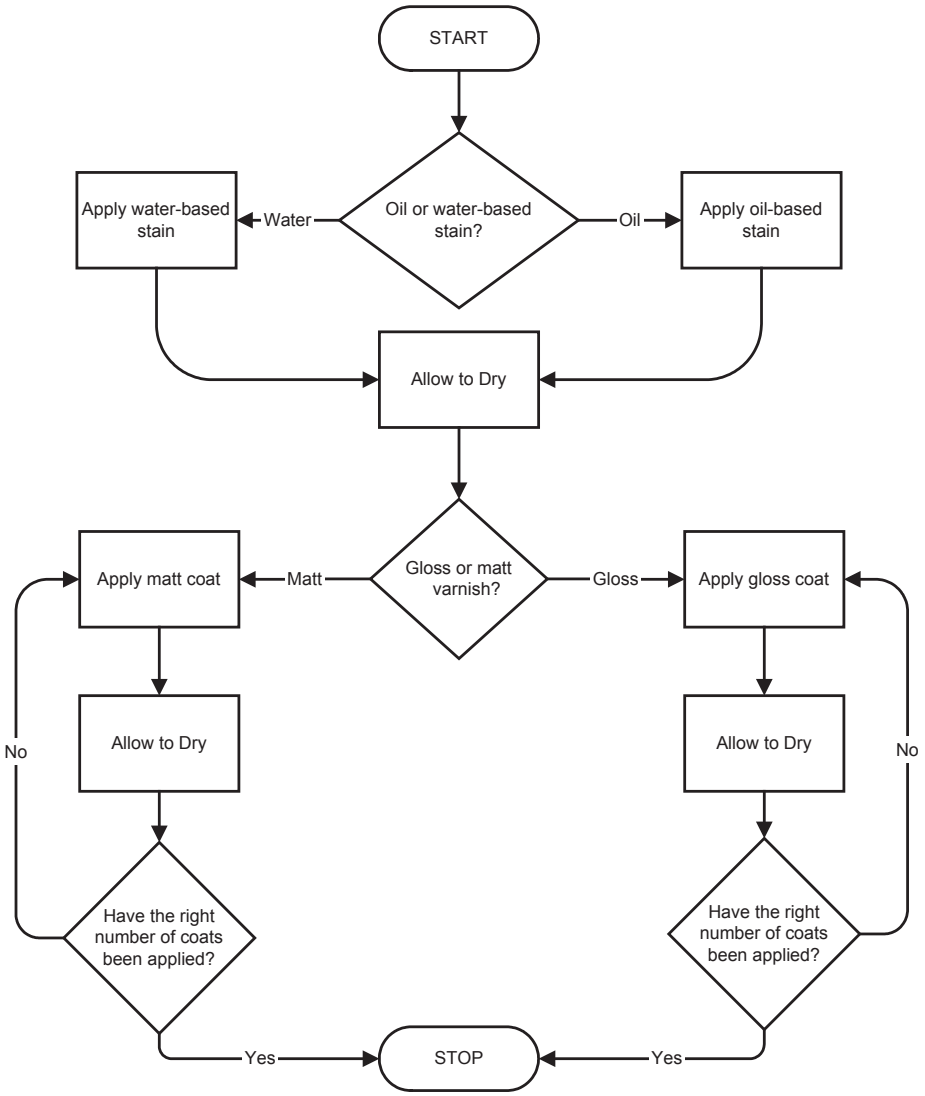

Table 2: Data for stains and varnishes

	Approximate coverage ($m^2 l^{-1}$)	Minimum drying time per coat	Coats required	Size of cans available		
				200 ml	500 ml	1 litre
Water-based stain	7	1 hr 30 mins	1	✓	✓	×
Oil-based stain	12	2 hrs 30 mins	1	✓	✓	×
Gloss varnish	14	4 hrs 30 mins	2	×	✓	✓
Matt varnish	10	3 hrs 30 mins	1	×	✓	✓

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(Question 1 continued)

(d) (i) From the flow chart, state the first decision that the homeowner will have to make as shown in Figure 4. *[1]*

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(ii) Calculate the minimum drying time required for the door to be stained with a water-based stain and matt varnished. *[3]*

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(e) (i) State **one** reason, apart from aesthetic reasons, for applying the varnish. *[1]*

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(ii) Deduce the number and sizes of cans of matt varnish the homeowner needs to purchase to complete the coating of the sides and edges of the door in Figure 4. *[3]*

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2. (a) Define *computer-aided design* (CAD). *[1]*

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(b) Explain why designers use a variety of modelling techniques, including drawing, to represent ideas. *[3]*

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3. (a) Compare user research with user trial. *[2]*

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(b) Outline **one** way in which planned obsolescence influences the product cycle. *[2]*

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

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(b) Explain how mycoprotein dough resulting from the fermentation process can be converted into a range of novel products. *[3]*

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5. (a) List **two** characteristics of glass. *[2]*

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(b) Describe cotton. *[2]*

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6. (a) Define *renewable resources*. *[1]*

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(b) Explain how energy utilization can be consistent with sustainable development. *[3]*

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SECTION B

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

7. **Figure 5** shows a freehand drawing of a concept car. The body shell for the concept car is to be produced in mild steel.

Figure 5: Freehand drawing of a concept car

(a) (i) Define *freehand drawing*. *[1]*

(ii) Describe the importance of annotating freehand drawings. *[2]*

(iii) Describe why concept cars are often a combination of radical and incremental design. *[2]*

(b) (i) Outline **one** reason why mild steel must be treated or finished for use in the car. *[2]*

(ii) Describe the relevance of plastic deformation in the shaping of the mild steel body parts for the car. *[2]*

(c) (i) List **two** features of the concept car which are influenced by fashion. *[2]*

(ii) Discuss how consideration of the strategies of reuse, repair and recycle at the design stage could be used to modify the environmental impact of a car. *[9]*

8. A designer is producing a range of disposable hooded ponchos (see **Figure 6**) to be sold at a cultural festival in the event of a sudden rainstorm. The ponchos will be decorated with the festival logo. S/he has decided to produce the adult poncho in three sizes – small, medium and large. The poncho will be made of a thermoplastic, polyethene. The seams of the poncho will be joined by heat fusing rather than stitching.

Figure 6: Hooded poncho

(a) (i) Define *percentile range.* *[1]*

(ii) List **two** reasons why the designer would design three sizes of adult poncho. *[2]*

(iii) Describe, in terms of the properties of the material, what might happen to the thermoplastic material if a very large person attempted to wear a small size poncho. *[2]*

(b) (i) List **two** disadvantages of cutting and machining the pieces for the poncho. *[2]*

(ii) List **two** advantages of heat fusing over stitching to join the pieces of the poncho together. *[2]*

(c) (i) Outline **one** advantage of selecting a thermoplastic for the production of the poncho. *[2]*

(ii) Evaluate **three** aspects of the hooded poncho design in terms of the extent to which it is consistent with the characteristics of sustainable development. *[9]*

9. **Figure 7 s**hows a levitating train that exploits superconducting technology. The train can carry up to 68 people (see **Figure 8**) and can reach speeds up to 581 km h^{-1}.

Figure 7: MLX01 levitating train

Figure 8: Inside view of MLX01

(a) (i) Define *superconductor.* *[1]*

(ii) Identify the relevance of constructive discontent in the ongoing development of superconductors. *[2]*

(iii) Outline **one** advantage of being able to produce superconducting materials that operate at room temperature. *[2]*

(b) (i) Describe how one-off production contributes to the volume production of sintered products. *[2]*

(ii) Outline **one** reason why economic considerations determine that sintered products are normally produced in volume. *[2]*

(c) (i) List **two** reasons why sintering can be considered as an example of a clean technology. *[2]*

(ii) Evaluate **three** aspects of the levitating train in terms of the extent to which it is consistent with sustainable development. *[9]*