



**DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 2**

Tuesday 3 November 2009 (afternoon)

1 hour

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.



SECTION A

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

1. The cardboard building for Westborough Primary School shown in **Figure 1** is Europe’s first permanent cardboard structure, providing a much-needed educational space anticipated to last 20 years. The building is 15 metres long and 6 metres wide. Cardboard tubes support the roof. The roof and walls are made from 90 % recycled cardboard.

The card panels for the walls are made up of three 50 mm thick layers of honeycomb and one 15 mm solid card. This provides strength from the solid card, and insulation from the honeycomb. A finish is applied to the panels.

Figure 1: Westborough Primary School



[Source <http://i.treehugger.com/files/cardboardschool.jpg>]

Buildings often have a layer of material coating the outside of the building to protect it. **Table 1** shows the thermal conductivity ratios of various materials often used in buildings. The ratios relate to how quickly heat is conducted through each material.

Table 1: Thermal conductivity ratio of materials used in buildings

material	ratio
brick	1.5
cardboard	0.5
cement	1.7

Expressed in gram-calories/second/square centimeter/centimeter°C

(This question continues on the following page)



(Question 1 continued)

(a) (i) State the material from **Table 1** which has the best thermal conductivity ratio. [1]

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(ii) Calculate the area of the cardboard building. [1]

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(iii) Calculate the thickness of one of the panels used in the cardboard building. [2]

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(b) (i) Describe why the panels are good insulators. [2]

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(ii) Outline **one** reason relating to safety why a finish is required for the cardboard building. [2]

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(c) (i) State **one** disadvantage of using cardboard as a building material. [1]

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(ii) Suggest **one** reason why cardboard has been used for the building even though it has a lower thermal conductivity rating than other materials. [3]

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2. (a) State **one** advantage of an isometric drawing. [1]

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(b) Discuss the relationship between morphological synthesis and attribute listing. [3]

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3. (a) Define *dominant design*. [1]

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(b) Explain **one** barrier for the diffusion of a product into the market place. [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.

4. **Figure 2** and **Figure 3** show a table designed by Ingo Maurer. The table has 278 light emitting diodes (LED) which are connected by tiny transparent wires embedded between two sheets of toughened glass. The LEDs are energy efficient and extremely bright. Ingo Maurer has decided to produce a limited amount of LED tables.

Figure 2: Ingo Maurers' LED Table

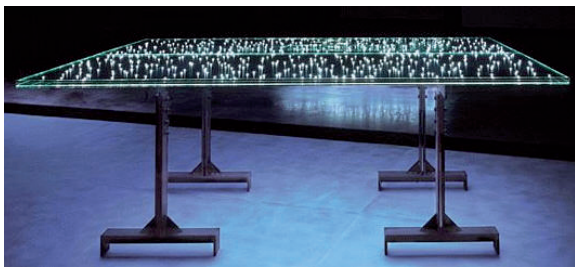


Figure 3: Close up of the LED table



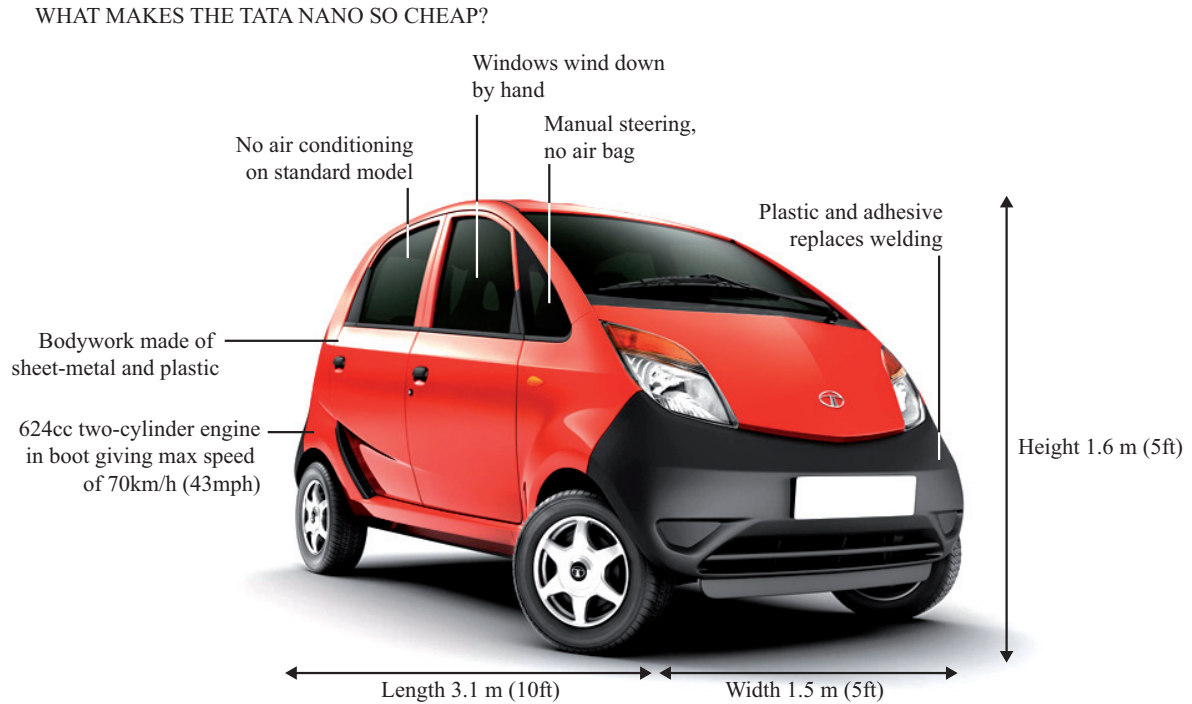
[Source: <http://www.inhabitat.com/2005/05/15/led-glass-table/>]

- (a) (i) Define *composite*. [1]
- (ii) Outline **one** physical property of glass that makes it suitable for the Ingo Maurer table. [2]
- (iii) Outline **one** reason why toughened glass was used for the Ingo Maurer tabletop. [2]
- (b) (i) State the most likely scale of production used for the LED table. [1]
- (ii) Evaluate the Ingo Maurer table as an example of radical and incremental design thinking. [3]
- (c) (i) Outline **one** likely market segment for the Ingo Maurer table. [2]
- (ii) Explain how consumers would evaluate the glass table with reference to purchase, initial use and long-term use. [9]



5. In 2008, the car company Tata developed the world’s cheapest car. Tata used low cost labour and standard sub-assemblies to reduce costs. A spokesperson for the Tata company stated that it is “a people’s car, designed to meet all safety standards and emissions laws and accessible to all”. An environmental concern is that the car will lead to increased air and pollution problems. **Figure 4** shows the car labelled which highlights some of its features.

Figure 4: Tata Nano car



[Source: adapted from http://newsimg.bbc.co.uk/media/images/44347000/jpg/_44347603_tata_car_416.jpg and <http://tatanano.inservices.tatamotors.com/tatamotors>]

- (a) (i) State **one** advantage of using plastic in the bodywork of the car. [1]
- (ii) Outline **one** reason why the bumper of the Tata Nano is made from plastic. [2]
- (iii) Identify **one** way the use of adhesives is a barrier to design for disassembly. [2]
- (b) (i) State the type of production process used for the Tata Nano. [1]
- (ii) Explain **one** reason why the company managed to keep production costs very low despite it being a labour-intensive process. [3]
- (c) (i) Outline **one** advantage of using performance testing in the design of car seatbelts. [2]
- (ii) Discuss **three** environmental disadvantages of the Tata Nano car. [9]



6. **Figure 5** shows the Italic bookshelf designed by Lorenz Wiegand. There are two standard components to the Italic bookshelf: bent steel rods and composite wooden shelves. The ends of the steel rods have been dipped into natural liquid gum to provide grip and hold the shelves in place.

Figure 5: The Italic bookshelf



[Source: <http://www.poolproducts-design.com/daten/de/p6.html>]

- (a) (i) State **one** mechanical property important to the design of the steel rods. [1]
- (ii) Describe **one** reason a composite timber is used in the Italic bookshelf. [2]
- (iii) Outline **one** advantage of using paint for the surface finish of the shelves. [2]
- (b) (i) Define *value for money*. [1]
- (ii) Explain **one** aspect of the Italic bookshelf that contributes to its cost-effectiveness. [3]
- (c) (i) Outline **one** design for manufacture strategy used in the Italic bookshelf. [2]
- (ii) Explain **three** green design strategies for the Italic bookshelf. [9]