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DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 2

Candidate session number

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Monday 18 November 2013 (afternoon)

1 hour 45 minutes

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 *[60 marks]*.

SECTION A

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

1. **Figure 1** shows The Shard, a landmark building designed by Renzo Piano and completed in 2012 in central London, UK. The Shard is 310 m (1016 ft) tall and it is the tallest skyscraper in Western Europe. The building's name is derived from a shard or splinter of glass created when glass shatters. To make the building more sustainable surplus heat is collected and used for underfloor heating; rain is channelled from the roof and used for showers and flushing toilets.

Figure 2 shows a closer view of The Shard with a spire at the top of the building. A spire is pyramid shaped and can be seen on many high buildings such as churches. The spire of The Shard was first pre-assembled in a field outside London then disassembled and taken to the site of The Shard to be assembled on top of the building. **Figure 3** shows the unusual shape of the spire.

Table 1 shows data about The Shard building.

Figure 1: The Shard building in central London

[Source: http://commons.wikimedia.org/wiki/File:The_Shard,_11_Novembre_2012_(tone).jpg]

Figure 2: The Shard building in close-up

[Source: Source: http://commons.wikimedia.org/wiki/File:Shard_London_Bridge_May_2012.JPG]

Figure 3: Spire of The Shard building

[Source: http://commons.wikimedia.org/wiki/File:The_Shard_4_(8288512193).jpg]

(This question continues on the following page)

(Question 1 continued)

Table 1: Data for The Shard building

Floors	Floor Area	Floor Use
75–87		Spire
68–72	8159 sq ft (758 m^2)	"The View" – observatory
53–65	62 129 sq ft (5772 m^2)	Residential apartments
52		Spa
34–52	174 355 sq ft (16 198 m^2)	Shangri-La Hotel
31–33	63 992 sq ft (5945 m^2)	Restaurants
2–28	586 509 sq ft (54 488 m^2)	Offices
0–1	22 627 sq ft (2102 m^2)	Lobby

[Source: © International Baccalaureate Organization 2014]

(a) (i) State **one** reason for including an observatory (The View) in the design of The Shard. *[1]*

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(ii) State **one** reason for including a spire at the top of the building. *[1]*

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(iii) Outline **one** reason for assembling the spire off-site before re-assembling it at the top of the building. *[2]*

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(Question 1 continued)

(b) (i) Outline **one** reason why the restaurant area is larger than the observatory area even though the observatory covers more floors. *[2]*

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(ii) Outline **one** reason why the restaurant area covers three floors. *[2]*

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(Question 1 continued)

(c) (i) State the number of floors not used regularly by people. *[1]*

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(ii) Suggest **one** possible reason for some floors remaining mainly unoccupied. *[3]*

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(Question 1 continued)

Table 2: Data about the glass panels used for the structure

- The glass panels are triple glazed sealed units.
- Each triple glazed panel is made up of three panes of glass with a motorized roller blind between the inner and outer layers.
- The blinds are automatically activated when the sun comes out and roll away when the sun goes in.
- The system reduces solar gain from 100 % on the outside to 12 % on the inside of the building.

[Source: © International Baccalaureate Organization 2014]

(d) (i) State **one** reason why solar heat gain will be less at the bottom of the building than at the top. *[1]*

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(ii) Explain why the blind systems may not help to reduce the energy needs of the building. *[3]*

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(Question 1 continued)

(e) (i) Outline **one** limitation of the blind system in relation to maintenance. *[2]*

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(ii) Outline **one** limitation of the blind system for occupants of the building. *[2]*

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2. (a) State the percentile range used for adult shoe sizes in volume production. *[1]*

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(b) Compare the use of qualitative and quantitative data when considering the ergonomic aspects of a design. *[3]*

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3. (a) Outline **one** reason why toughness is important in the use of timber for roof beams in domestic buildings. *[2]*

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(b) Describe how the structure of natural timber affects how a beam is cut to maximize its tensile strength. *[2]*

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4. (a) State **one** reason why the concept of clean technology was **not** an issue for most governments during the industrial revolution. *[1]*

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(b) Explain **one** reason why many approaches to clean manufacturing tend to be incremental. *[3]*

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5. (a) Describe how the structure of laminated veneer lumbar (LVL) differs from the structure of plywood. *[2]*

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(b) Outline **one** limitation of the composition of particle board (chipboard) for use as a structural material. *[2]*

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6. (a) State **one** limitation of installing a hydroelectric system. *[1]*

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(b) Compare the overall efficiency conversion levels of using conventional coal and gas fossil fuels to create electricity. *[3]*

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SECTION B

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

7. **Figure 4** shows the Porsche RS bicycle available at a cost of approximately US$8000. The company Porsche is most well known for its range of high performance cars. The bicycle is designed for "urban use" rather than racing and so has 50 mm (2") wide tyres. The pedals can only be used effectively if the user wears cycling shoes. **Figure 5** shows the chain drive system of the bicycle.

Figure 4: Porsche RS bicycle

Figure 4 removed for copyright reasons

Figure 5: Chain drive system

Figure 5 removed for copyright reasons

(a) (i) Outline **one** possible reason why Porsche decided to produce bicycles as part of their corporate strategy. *[2]*

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This question continues on the following page)

(Question 7 continued)

(ii) Describe the specific type of corporate strategy employed by Porsche in deciding to produce bicycles. *[2]*

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(b) (i) Outline **one** advantage of manufacturing the pedals of the bicycle by high-pressure die casting. *[2]*

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(ii) Explain how work done by the cyclist is converted into mechanical motion when riding the bicycle. *[3]*

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(Question 7 continued)

(c) (i) Outline **one** reason why the pedals are designed so the cyclist has to wear specialist shoes. *[2]*

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(ii) Explain **three** reasons why many governments promote the use of bicycles as a form of transport. *[9]*

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8. **Figure 6** shows the Honda NSX concept car exhibited at the Detroit Auto Show (US) in 2012. A concept car is a pre-production model which allows participants at a motor show to evaluate a car within the confines of the showroom. It is planned that the Honda NSX will be on sale to the general public by 2015.

Figure 6: Honda NSX concept car

[Source: Source: Honda. Used with permission]

(a) (i) Outline **one** reason why Honda decided to produce a hybrid version of the NSX car rather than an all electric version. *[2]*

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(Question 8 continued)

(ii) Describe how the introduction of electricity impacted on the market for mass produced motor cars. *[2]*

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(b) (i) Outline the life cycle stage of a life cycle analysis (LCA) in which a car has most impact on the environment. *[2]*

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(ii) Explain why a car company may decide to produce a concept car for auto shows even though they have no intention of turning it into a full production model. *[3]*

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(Question 8 continued)

(c) (i) Outline **one** advantage to the consumer of cars produced by just-in-time (JIT). *[2]*

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(ii) Discuss the value of the use of the evaluation strategies of user trial, user research and expert appraisal to a car company when placing a concept car in an auto show. *[9]*

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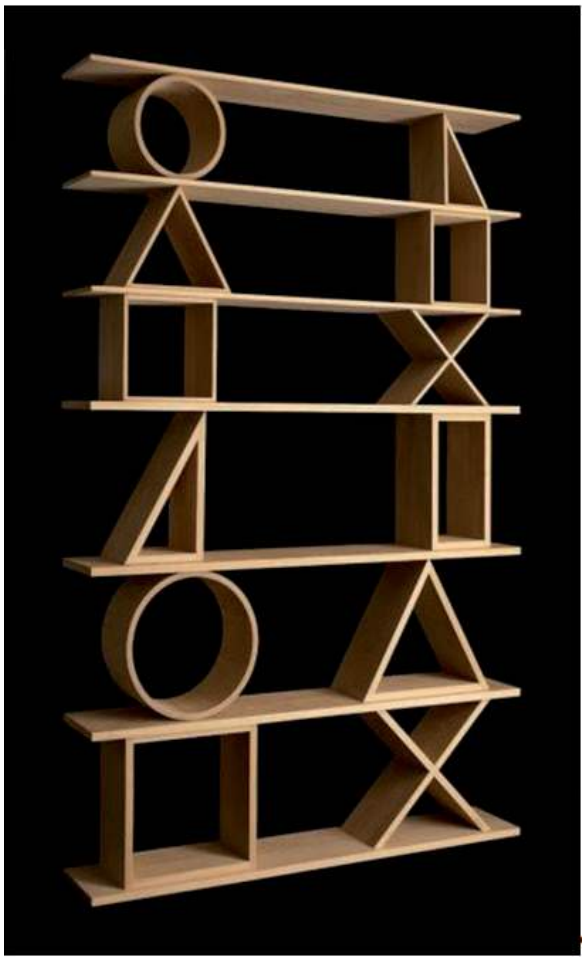
9. **Figure 7** shows a Geo Shelving unit designed and made in France by Drugeot-Labo company. The unit is constructed from hardwood (oak) sourced from a sustainable forest although the circle shapes are made from manufactured board (MDF) with an oak veneer. The shelving unit is manufactured by skilled craftsmen, assembled in the factory and delivered to the customer as one piece.

Figure 7: Geo Shelving Unit



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

(a) (i) Outline the scale of production for the Geo Shelving unit. *[2]*

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(Question 9 continued)

(ii) Outline **one** use of mechanization in the production of the Geo Shelving unit. *[2]*

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(b) (i) Outline **one** reason why the circle shapes have not been produced from hardwood. *[2]*

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(ii) Explain how permanent joining techniques lead to planned obsolescence and associated environmental issues. *[3]*

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(Question 9 continued)

(c) (i) Outline **one** reason why distribution costs will be high for the Geo Shelving unit. *[2]*

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(ii) Suggest **three** considerations in the design of the Geo shelving unit relating to the effect of external loads on the unit during use. *[9]*

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