22146205

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 2

Candidate session number

Monday 19 May 2014 (afternoon)

1 hour

Examination code

2	2	1	4	–	6	2	0	5

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]*.

16EP01

SECTION A

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

1. **Figure 1** shows the Flex-Foot Cheetah® blade worn by paralympian athletes. It is designed to imitate a human foot and is manufactured by the Össur company from carbon fibre composite material. The "J" curve shape of the Cheetah blade resembles the shape of the hindquarters of a cheetah – the fastest animal on land. The Cheetah blade works when vertical forces generated at the heel contact are stored and translated into linear motion (**Figure 2**). Data relating to the Cheetah blade are shown in **Table 1**.

Figure 1: Paralympian athlete wearing a Cheetah blade

Table 1: Data for the Cheetah blade

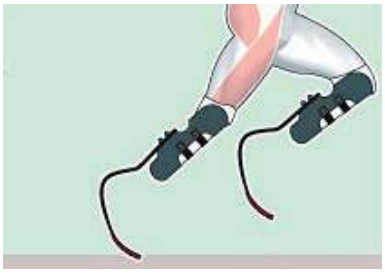
- The maximum weight of user is 147 kg (325 lbs).
- The weight of blade is 512 g.
- 90 % of stored energy is released during running.
- The Cheetah blade is available in different sizes.
- The toe shape and the tread plate (surface contact with the ground) can be customized.
- For competitions a spike plate of a running shoe or the sole of an athletic shoe can be attached.
- Materials research development for the Cheetah blade took 20 years.
- Carbon fibre has vertical shock absorption qualities.
- The carbon technology can be manipulated to provide a variety of blade configurations to meet the user's needs.
- The blade has more layers of carbon at high stress points and fewer where flexibility is required.

[Source: : www.ossur.co.uk. Used with permission.]

Figure 2: How the Cheetah blade works

The Cheetah blade compresses, storing energy.

The stored energy in the blade moves to the front edge.



The Cheetah blade releases energy like a spring.

[Source: : www.ossur.co.uk. Used with permission]

(This question continues on the following page)

(Question 1 continued)

(a) (i) State **one** reason why the Cheetah blade has been designed to absorb vertical shock. *[1]*

. . . . . .
. . . . . .

(ii) State **one** benefit of using carbon fibre composite for the Cheetah blade in relation to strength-to-weight ratio. *[1]*

. . . . . .
. . . . . .

(iii) Outline **one** reason why materials development for the Cheetah blade took so long even though carbon fibre is not a new material. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(b) (i) Outline **one** reason for designing the Cheetah blade so that the toe shape can be customized. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 1 continued)

(ii) Outline **one** reason for designing the Cheetah blade so the tread plate can be customized. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(c) (i) State the manufacturing technique for the Cheetah blade. *[1]*

. . . . . .
. . . . . .

(ii) Explain why the Cheetah blade is manufactured in different thicknesses. *[3]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

2. (a) State the percentile that would be used to decide the maximum height for a supermarket shelf. *[1]*

. . . . . .
. . . . . .

(b) Explain why percentile ranges for the stature (height) of adults are based on the 19–65 age range. *[3]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

3. (a) Define *planned obsolescence*. *[1]*

. . . . . .
. . . . . .

(b) Explain how the work of a designer influences both the cost and the value of a product. *[3]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

SECTION B

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

4. **Figure 3** shows the Secret Clubhouse outdoor chair designed by Martin Vallin and produced by the Cappellini company. The chair is made from recycled wood and has a polyurethane foam cushion with a textile cover. The chair has a wooden frame with a "shell" made from interwoven thin lengths of timber fixed to the frame.

Figure 3: Secret Clubhouse chair

[Source: Reproduced with permission from Martin Vallin http://www.maav.se/]

(a) (i) State **one** reason why analogy may have been the primary generator of ideas for the chair. *[1]*

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 4 continued)

(ii) Outline **one** possible reason for the name of the chair. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(iii) Outline the type of production system for manufacturing the chair. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(b) (i) State the percentile used to decide the height of the seat from the floor. *[1]*

. . . . . .
. . . . . .

(ii) Explain **one** potential safety issue for the use of the chair. *[3]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 4 continued)

(c) (i) Outline **one** possible maintenance issue for the chair. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(ii) Discuss **three** possible reasons why the Secret Clubhouse chair is likely to have a relatively high price when marketed. *[9]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

5. **Figure 4** and **Figure 5** show a Frisbee™ flying disc – a plastic disc-shaped glider 20–25 mm in diameter with a lip so it can be gripped easily. The disc is an aerofoil shape in cross-section allowing it to fly by generating lift as it moves through the air while spinning. Flying discs are thrown and caught as a game either for recreation or competition. There are many variations of Frisbee available.

The Frisbee was developed by Walter Morrison (US) in 1938, when he was playing a flying game on a beach using a cake pan as a disc. Onlookers offered Morrison money for the cake pan so they could play the game. After more design development work, Morrison sold the rights to his design to the toy company Wham-O who named the disc Frisbee. Further refinements improved the disc so it could be controlled more accurately.

Figure 4: Frisbee™ flying disc

[Source: http://en.wikipedia.org/wiki/File:Frisbee_090719.jpg by Wham-O]

Figure 5: The Frisbee™ in action

[Source: http://en.wikipedia.org/wiki/File:Frisbee_Catch-_Fcb981.jpg, by Eric Baetscher]

(a) (i) State the most important physical property for the choice of material for the Frisbee. *[1]*

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 5 continued)

(ii) Outline the influence of market pull and technology push on the design of the Frisbee. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(iii) Outline the major anthropometric consideration for the design of the Frisbee. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(b) (i) State the manufacturing technique for production of the Frisbee. *[1]*

. . . . . .
. . . . . .

(ii) Explain how the design of the Frisbee reflects radical and incremental thinking. *[3]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 5 continued)

(c) (i) Describe the influence of fashion on the popularity of the Frisbee. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(ii) Discuss the influence of science, technology and design on the innovation of the Frisbee. *[9]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

6. **Figure 6** shows the Kiddy Guardian Pro 2 Car Seat suitable for children aged between 9 weeks and 12 years old. The seat has a protective impact cushion in front of the child that should be used for children up to 3 years old (18 kg in weight) as shown in **Figure 7**. It also has a foldable/removable insert cushion that can be adjusted to provide extra support as the child grows. The seat cushions are made from polyurethane foam with a breathable fabric cover that can be removed.

Figure 6: The Kiddy Guardian Pro 2 Car Seat

[Source: Used with permission from kiddy GmbH Company]

Figure 7: The Kiddy Guardian Pro 2 Car Seat with and without the protective impact cushion positioned

[Source: www.kiddy.de. Used with permission from kiddy GmbH Company]

(This question continues on the following page)

(Question 6 continued)

(a) (i) State **one** disadvantage of using polyurethane foam to manufacture the car seat in relation to green design. *[1]*

. . . . . .
. . . . . .

(ii) Outline **one** advantage of using polyurethane foam to manufacture the car seat in relation to comfort. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(iii) Outline **one** maintenance issue for the choice of material for the car seat cover. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 6 continued)

(b) (i) State **one** psychological factor relating to the ergonomics of the car seat. *[1]*

. . . . . .
. . . . . .

(ii) Discuss the life cycle of the car seat. *[3]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 6 continued)

(c) (i) Outline **one** reason why the fabric cover for the car seat is designed to be breathable. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(ii) Discuss how the evaluation strategies of user trial, field trial and performance testing would have been used in the design development of the car seat. *[9]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

Please **do not** write on this page.

Answers written on this page
will not be marked.