Diploma Programme
Programme du diplôme
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Programa del Diploma

Design technology
Higher level and standard level
Paper 2

Monday 20 May 2019 (afternoon)

1 hour 30 minutes

Candidate session number

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.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.

2219–6203

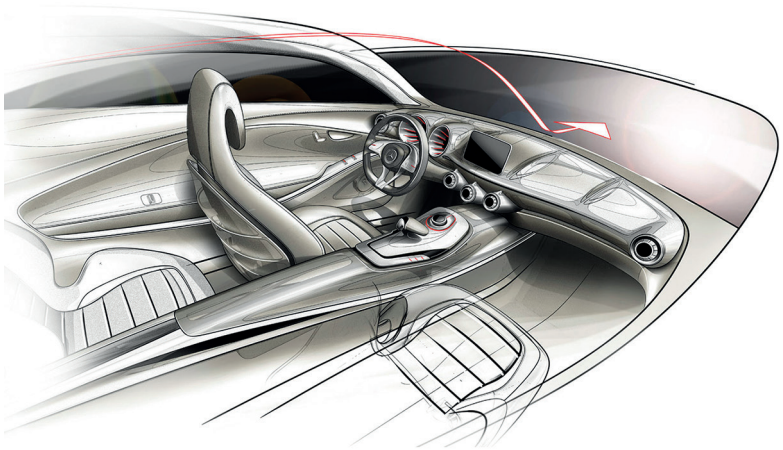
21 pages

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

1. The design and development of a car is a complex process and involves many different teams. One team is responsible for the ergonomics of the interior of the car, see **Figure 1** and **Figure 2**.

Figure 1: Rendering of a car interior



[Source: © Daimler AG]

Figure 2: 2D graphics of the ergonomics of an interior

[Source: Opel]

(This question continues on the following page)

(Question 1 continued)

(a) (i) Define the term *ergonomics*. [1]

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(ii) Outline why biomechanics is important in car design. [2]

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(b) (i) Outline why different percentile ranges are used in car design. [2]

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(ii) Outline why dynamic data is used in car design. [2]

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(Question 1 continued)

(c) (i) Outline **one** way in which psychological factor data can influence the design of a car. [2]

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(ii) Explain how legislation can be used to enable incremental green design to occur in car design. [3]

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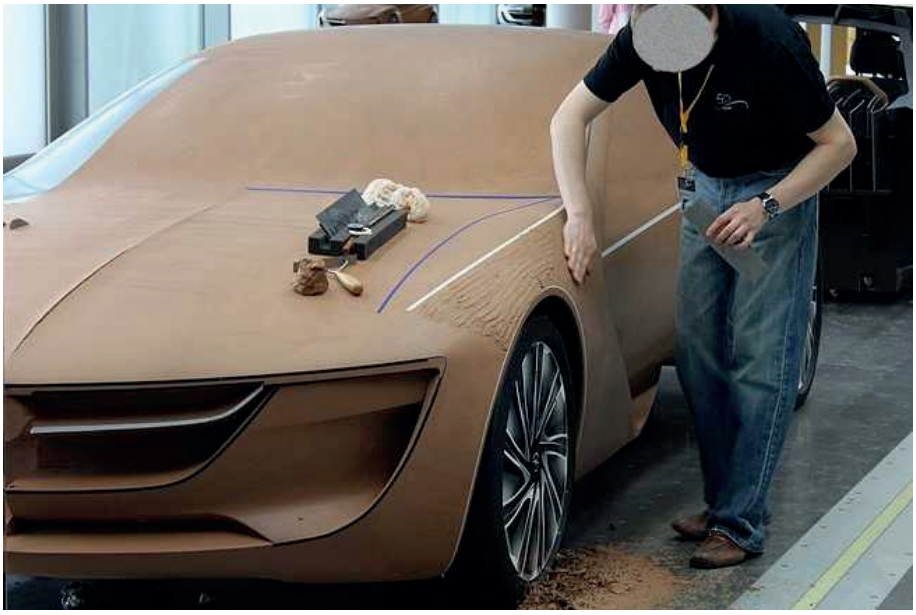
(Question 1 continued)

The design of a car is a process that has many stages. As a result, there can be a large number of prototypes and drawings used.

Some car designers are still using clay to make their first prototype of a new model of car, see **Figure 3**.

Figure 3: The use of a full-sized clay model



[Source: adapted image (cropped and blurred) "zu Besuch um Opel Designzentrum, Rüsselsheim" by Robert Basic from https://commons.wikimedia.org. Under copyright and creative commons licence 2.0 (https://creativecommons.org/licenses/by-sa/2.0/deed.en).]

(d) (i) List **one** reason why clay modelling is still used to prototype models in processes such as car design. [1]

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(ii) Describe the difference between surface and solid modelling. [2]

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(Question 1 continued)

(e) (i) Outline why isometric drawings are often used in car design. [2]

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(ii) Explain why digital humans are used in car interior design. [3]

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2. With the introduction of sound in movies, the clapperboard was invented in the 1930s in Melbourne to align sight and sound during the editing process. An example of a clapperboard is shown in **Figure 4**.

Figure 4: A traditional clapperboard

[Source: MrGandy https://commons.wikimedia.org]

(a) Outline why the clapperboard can be defined as a classic design. [2]

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(b) Outline why the clapperboard is in the maturity phase of its product cycle. [2]

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3. Explain why end-of-pipe technologies may not be the most effective strategy to reduce pollution. [3]

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4. Designers often strive to design products that enable the principles of the circular economy to be met. However, products are designed so that they cannot be easily disassembled.

Explain why some products are designed so they cannot be easily disassembled. [3]

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Section B

Answer **one** question. Answers must be written within the answer boxes provided.

5. In 1932 an automotive engineer used his knowledge of car suspension to design the Anglepoise lamp, see **Figure 5**. The Anglepoise lamp can be manufactured out of recycled steel and is regarded as a classic design.

Figure 5: The Anglepoise lamp

[Source: Copyright Anglepoise Holdings Ltd]

(a) Describe the difference between recycling and reusing. [2]

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(Question 5 continued)

(b) Explain why the innovation strategy for the Anglepoise lamp is an example of adaptation. [3]

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(Question 5 continued)

(c) Different joining techniques may have been used when joining the steel parts of the Anglepoise lamp.

Suggest **two** different joining techniques that could have been used to join the metals in the Anglepoise lamp. [6]

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(Question 5 continued)

(d) Explain how omnipresence, image **and** dominant design make the Anglepoise lamp a classic design. [9]

6. Choosing the right material(s) for a product such as a bridge is a complex and difficult task as each one has different physical, aesthetic and mechanical properties. In addition, there may be environmental, social, cultural, moral and ethical issues associated with the choice of material(s).

The Anzac Bridge in Sydney, Australia is a cable-stayed bridge made of reinforced concrete and steel cable, see **Figure 6**. There is a patent on the cables.

Figure 6: The Anzac Bridge

[Source: Adapted image (cropped) “Anzac Bridge” by Stephen Kelly from www.flickr.com. Under copyright and creative commons licence 2.0 (https://creativecommons.org/licenses/by/2.0/).]

In other cases, bridge designers have used traditional materials such as wood. **Figure 7** shows a timber bridge in Canada.

Figure 7: A timber bridge

[Source: image by Stéphane Groleau]

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(Question 6 continued)

(a) Outline why designers would register a patent. [2]

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(b) Explain why the recycling of steel-reinforced concrete is problematic. [3]

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(Question 6 continued)

(c) Discuss the conflict between form **and** function when designing a new bridge. [6]

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(Question 6 continued)

(d) Explain why timber as a building material is influenced by its physical properties, aesthetic properties **and** environmental impact. [9]

7. Over the last five years there has been an increase in the number of people that own a smartwatch, see **Figure 8**. Users can listen to music, browse social media or find out about the weather on their smartwatch. Many smartwatches are assembled by robotic manufacturing systems.

Figure 8: A smartwatch

[Source: fancycrave1 www.pixabay.com]

(a) List **two** properties that are required in the materials used in a smartwatch. [2]

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(Question 7 continued)

(b) Explain **one** reason why the smartwatch is an example of a converging technology. [3]

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(Question 7 continued)

(c) Explain **two** ways how the use of robotic manufacturing systems can assist in the production of smartwatches. [6]

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(Question 7 continued)

(d) Explain how sustaining innovation, disruptive innovation **and** process innovation apply to the development of the smartwatch. [9]

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