

No part of this product may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without written permission from the IB.

Additionally, the license tied with this product prohibits commercial use of any selected files or extracts from this product. Use by third parties, including but not limited to publishers, private teachers, tutoring or study services, preparatory schools, vendors operating curriculum mapping services or teacher resource digital platforms and app developers, is not permitted and is subject to the IB's prior written consent via a license. More information on how to request a license can be obtained from <http://www.ibo.org/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

Aucune partie de ce produit ne peut être reproduite sous quelque forme ni par quelque moyen que ce soit, électronique ou mécanique, y compris des systèmes de stockage et de récupération d'informations, sans l'autorisation écrite de l'IB.

De plus, la licence associée à ce produit interdit toute utilisation commerciale de tout fichier ou extrait sélectionné dans ce produit. L'utilisation par des tiers, y compris, sans toutefois s'y limiter, des éditeurs, des professeurs particuliers, des services de tutorat ou d'aide aux études, des établissements de préparation à l'enseignement supérieur, des fournisseurs de services de planification des programmes d'études, des gestionnaires de plateformes pédagogiques en ligne, et des développeurs d'applications, n'est pas autorisée et est soumise au consentement écrit préalable de l'IB par l'intermédiaire d'une licence. Pour plus d'informations sur la procédure à suivre pour demander une licence, rendez-vous à l'adresse <http://www.ibo.org/fr/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

No se podrá reproducir ninguna parte de este producto de ninguna forma ni por ningún medio electrónico o mecánico, incluidos los sistemas de almacenamiento y recuperación de información, sin que medie la autorización escrita del IB.

Además, la licencia vinculada a este producto prohíbe el uso con fines comerciales de todo archivo o fragmento seleccionado de este producto. El uso por parte de terceros —lo que incluye, a título enunciativo, editoriales, profesores particulares, servicios de apoyo académico o ayuda para el estudio, colegios preparatorios, desarrolladores de aplicaciones y entidades que presten servicios de planificación curricular u ofrezcan recursos para docentes mediante plataformas digitales— no está permitido y estará sujeto al otorgamiento previo de una licencia escrita por parte del IB. En este enlace encontrará más información sobre cómo solicitar una licencia: <http://www.ibo.org/es/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

Design technology
Higher level and standard level
Paper 2

Monday 20 May 2019 (afternoon)

Candidate session number

1 hour 30 minutes

--	--	--	--	--	--	--	--	--	--

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]**.

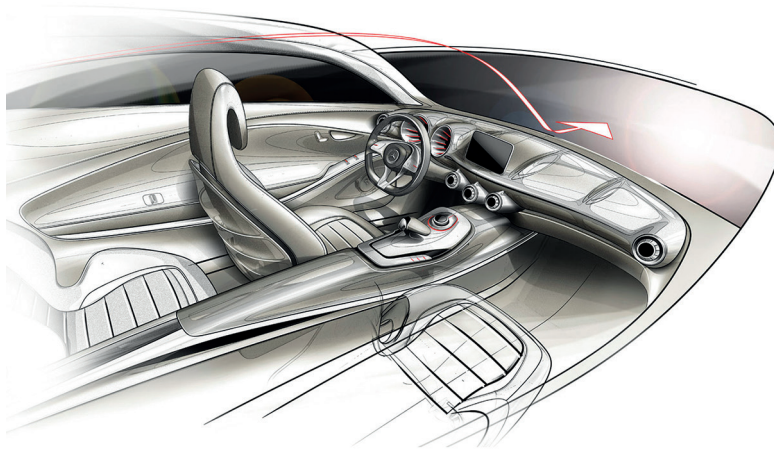


Section A

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]

.....
.....

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

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

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

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

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

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

(This question continues on the following page)



24EP03

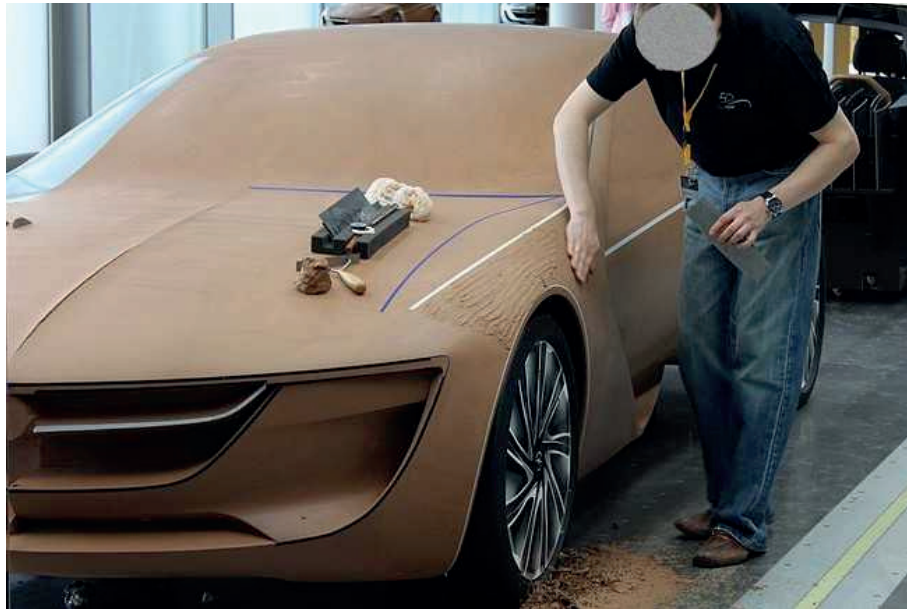
Turn over

(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]

.....
.....

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

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

(This question continues on the following page)



24EP05

Turn over

(Question 1 continued)

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

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



- 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]

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....



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

Answers written on this page
will not be marked.



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

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



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]

.....

.....

.....

.....

.....

.....

(This question continues on the following page)



(Question 5 continued)

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(This question continues on the following page)



(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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(This question continues on the following page)

(Question 5 continued)

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

[9]

A large rectangular box containing horizontal dotted lines for writing the answer to the question.



24EP13

Turn over

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]

(This question continues on the following page)



(Question 6 continued)

(a) Outline why designers would register a patent.

[2]

.....

.....

.....

.....

.....

.....

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

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

(This question continues on the following page)



(Question 6 continued)

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

[6]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(This question continues on the following page)



(Question 6 continued)

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

[9]

A large rectangular area with horizontal dotted lines for writing.



24EP17

Turn over

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]

.....

.....

.....

.....

.....

.....

(This question continues on the following page)



(Question 7 continued)

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(This question continues on the following page)



(Question 7 continued)

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

[9]

A large rectangular box containing horizontal dotted lines for writing the answer.



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

Answers written on this page
will not be marked.



24EP22

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

Answers written on this page
will not be marked.



24EP23

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

Answers written on this page
will not be marked.



24EP24