

© International Baccalaureate Organization 2024

All rights reserved. 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 the prior written permission from the IB. Additionally, the license tied with this product prohibits 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, whether fee-covered or not, is prohibited and is a criminal offense.

More information on how to request written permission in the form of a license can be obtained from <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organisation du Baccalauréat International 2024

Tous droits réservés. 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 préalable de l'IB. De plus, la licence associée à ce produit interdit toute utilisation 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, moyennant paiement ou non, est interdite et constitue une infraction pénale.

Pour plus d'informations sur la procédure à suivre pour obtenir une autorisation écrite sous la forme d'une licence, rendez-vous à l'adresse <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organización del Bachillerato Internacional, 2024

Todos los derechos reservados. 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 la previa autorización por escrito del IB. Además, la licencia vinculada a este producto prohíbe el uso 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—, ya sea incluido en tasas o no, está prohibido y constituye un delito.

En este enlace encontrará más información sobre cómo solicitar una autorización por escrito en forma de licencia: <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

# Design technology

## Higher level

### Paper 1

8 May 2024

Zone A afternoon | Zone B afternoon | Zone C afternoon

1 hour

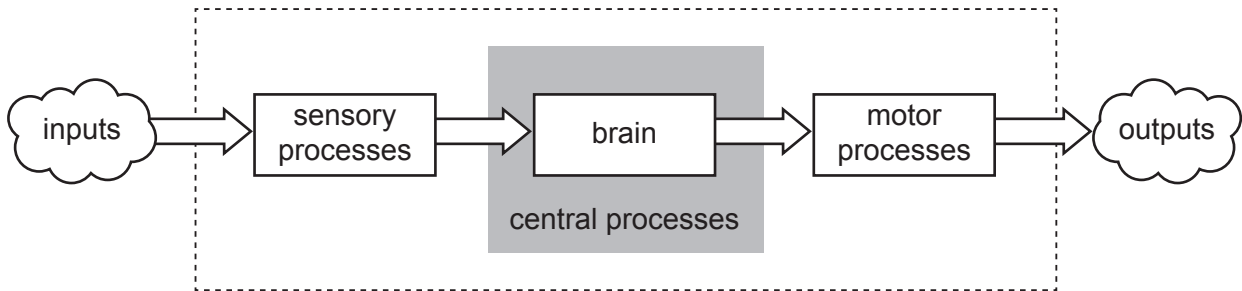
---

#### Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is **[40 marks]**.

1. **Figure 1** shows a flow diagram representing a human information processing system.

**Figure 1: Human information processing system diagram**



Which part of the human information processing system is related to physiological factors?

- A. Motor processes
  - B. Central processes
  - C. Sensory processes
  - D. Inputs
2. Which of the following percentile data is most likely to be used for the adjustable seats in an automobile?
- A. 50th
  - B. 75th
  - C. 5th-95th
  - D. 1st-99th
3. When considering the furniture for an open-plan office, which aspect of ergonomics would be most important?
- A. Adjustability
  - B. Range of sizes
  - C. Reach
  - D. Clearance

4. What natural resources can be identified in terms of quantity and quality?
- A. Renewable
  - B. Non-renewable
  - C. Reserve
  - D. Renewability
5. **Figure 2** shows the BMW Group Recycling and Dismantling Centre (RDC) in Germany. Parts of cars are separated by material for future use.

**Figure 2: BMW Group Recycling and Dismantling Centre (RDC)**



Which product recovery strategy is BMW using?

- A. Raw material
- B. Waste electrical and electronic equipment (WEEE) recovery
- C. Recycling
- D. Waste to energy

6. The aim of end-of-pipe technology is to reduce which aspect of the production process?
- A. Energy
  - B. Labour
  - C. Pollution
  - D. Lead time
7. **Figure 3** shows *Pritt Stick* adhesive used for gluing paper and card. It was originally invented in 1969; more recently the company has improved the formulation so it is now made from 97% natural ingredients.

**Figure 3: *Pritt Stick* adhesive**



What is this change to the increased use of natural materials an example of?

- A. Clean Technology
- B. Life cycle analysis (LCA)
- C. Reconditioning
- D. Green design

8. Which of the technologies listed can also be referred to as a converging technology?
- I. Nanotechnology
  - II. Haptic technology
  - III. Biotechnology
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
9. The Stanford Solar Car Project (SSCP) is a team of students who design, build, and test a solar-powered electric vehicle. **Figure 4** shows a student testing the inside of the driver’s cockpit.

**Figure 4: Testing the Stanford Solar Car cockpit**



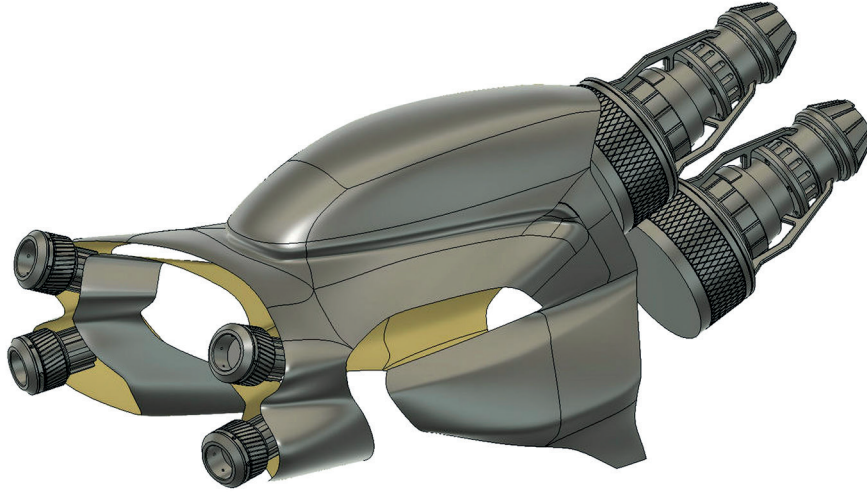
[Source: Jim Merithew, Wired, © Condé Nast.]

Which of the following best describes the type of model shown in **Figure 4**?

- A. Mock-up
- B. Aesthetic
- C. Finite element analysis (FEA)
- D. Scale

10. **Figure 5** shows a computer-aided design (CAD) concept model part of a Space Drone project that focuses on the style of the design rather than the technical internal data.

**Figure 5: Concept Space Drone**



What type of model is shown in **Figure 5**?

- A. Surface
- B. Solid
- C. Virtual
- D. Animation

11. **Figure 6** shows the UFO Sinker, a lead-free fishing weight made of a unique high density concrete composite as an environmentally friendly alternative for traditional sinkers made of lead.

**Figure 6: UFO Sinker lead-free fishing weights**



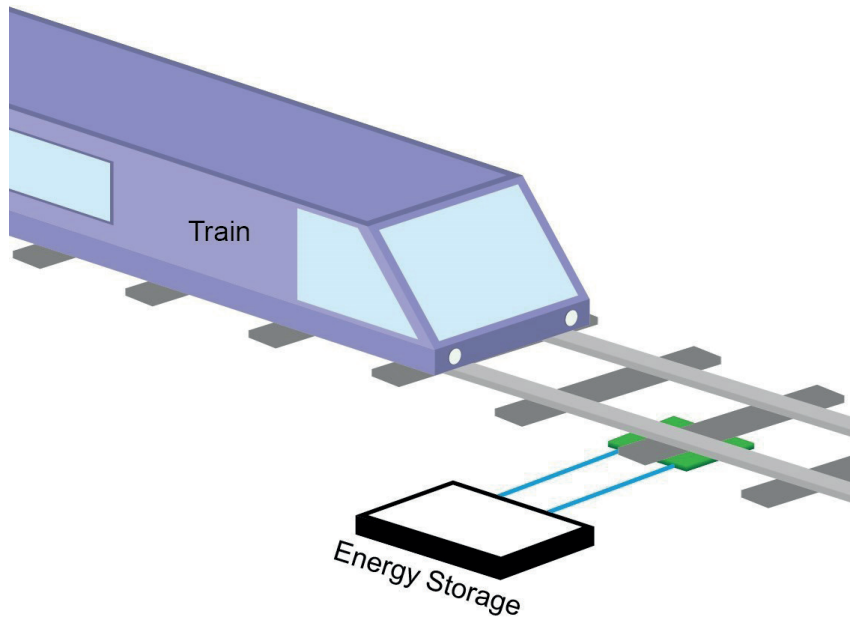
What property of the material is essential for the UFO Sinker to work effectively?

- A. Mass
- B. Hardness
- C. Weight
- D. Toughness



12. **Figure 7** shows an example of a smart technology developed by international company Innitrix. This smart material generates energy from pressure and stress on the railway track of passing trains to generate electricity.

**Figure 7: Smart material used to generate electricity**



Which property applies to this smart material?

- A. Thermoelectric
  - B. Piezoelectric
  - C. Shape memory alloy
  - D. Electro-rheostatic
13. Modifying the physical properties of a material by decreasing the hardness and brittleness but increasing the ductility is known as:
- A. Alloying
  - B. Tempering
  - C. Work hardening
  - D. Grain size

14. Camping tents, as shown in **Figure 8**, are made from high-performance synthetic textiles as they require a high strength-to-weight ratio.

**Figure 8: Camping tent**



Which synthetic textile material is best suited as the fabric of choice for tents?

- A. Polyester
- B. Nylon
- C. Lycra®
- D. Polystyrene

15. Which shaping technique has been used in the manufacture of the metal hair pins shown in **Figure 9**?

**Figure 9: Metal hair pins**



- A. Moulding
  - B. Casting
  - C. Thermoforming
  - D. Laminating
16. Which one of the following statements relates to one-off production?
- A. High-quality, high-volume production
  - B. Low-cost, high-volume production
  - C. High-cost, low-volume production
  - D. Low-quality, low-volume production

17. Robotic manufacturing systems that have their own central control unit containing machine vision sub-systems acting as their “eyes” are known as:
- A. Mechanized robots
  - B. Multi-task robots
  - C. Machine to machine (M2M) robots
  - D. Wired robots
18. **Figure 10** shows the *chapeau claque* collapsible top hat which folds flat for easy storage. *Chapeau* is the French word for “hat” and the word *claque* refers to the sound the hat makes as it opens with the help of a spring.

**Figure 10: *Chapeau claque* collapsible top hat**



Which strategy was used to decide the name for the hat?

- A. Analogy
- B. Adaptation
- C. Chance
- D. Insight

19. USB ports and cables as shown in **Figure 11**, allow the transfer of data and power between devices with relative ease. USB-C (shown on the right) is slowly becoming the standard port for consumer electronic devices.

USB-C ports:

- are smaller and thinner than USB-A (shown on the left)
- can be inserted either way whereas USB-A can only be inserted one way
- allow for faster data transfer speeds compared to USB-A.

**Figure 11: USB-A (shown left) and USB-C (shown right)**



Which of the following types of obsolescence will occur with the USB-A?

- I. Functional obsolescence
  - II. Planned obsolescence
  - III. Technological obsolescence
- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III
20. What is an advantage of obsolescence to the consumer?
- A. Cheaper products
  - B. Safer products
  - C. More innovative products
  - D. More durable products

21. **Figure 12** shows a BIC ballpoint pen first manufactured in the 1950s when it was seen as a radical new product. It has undergone only minor design changes since and still sells well.

**Figure 12: BIC ballpoint pen**

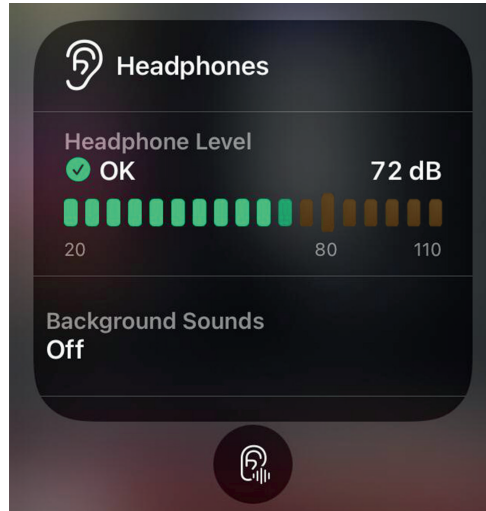


What is the most likely reason for the continued success of the pen?

- A. Very little competition in the marketplace
  - B. Ballpoint pens will never become obsolete
  - C. It is still viewed as a pioneering design
  - D. It has a good balance of form and function
22. Which members of a user-centred design (UCD) team are concerned with the assessment, diagnosis, treatment, and prevention of mental disorders?
- A. Anthropologists
  - B. Ethnographers
  - C. Psychologists
  - D. Ergonomists

23. In 2019, Apple added a feature to headphones that prevented users from being exposed to high levels of sound (80 decibels) for extended periods of time. **Figure 13** shows this feature on the device interface.

**Figure 13: Real-time audio level monitoring interface**

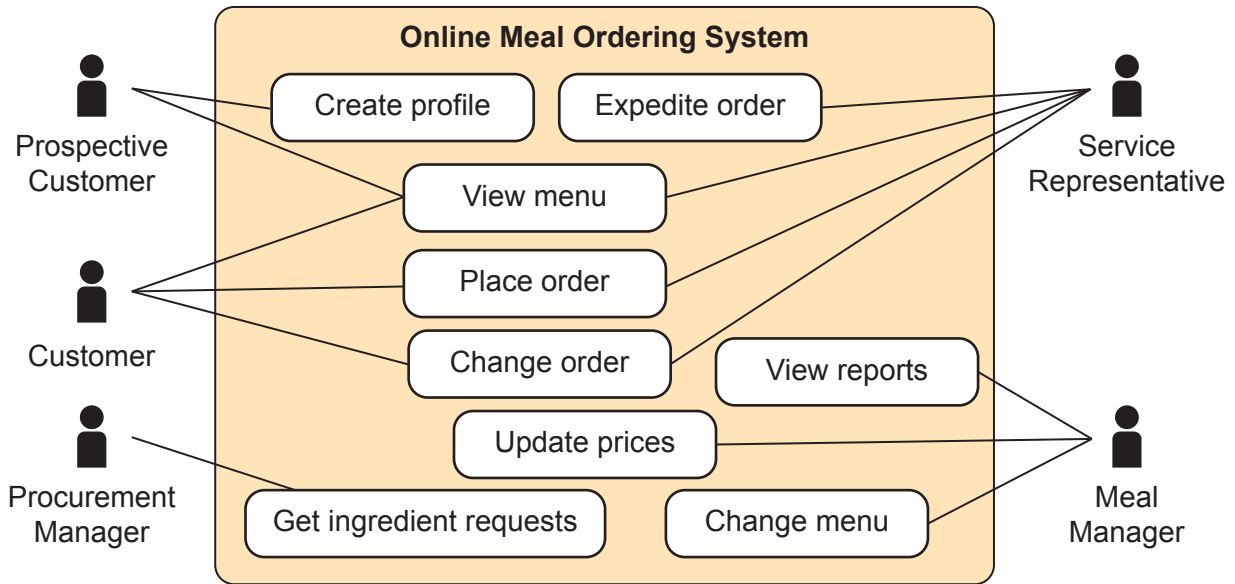


Which of the following characteristics has been prioritized in this user interface?

- A. Feedback
- B. Constraint
- C. Mapping
- D. Visibility

24. **Figure 14** shows the possible sequences of interactions between all users in the project planning of a new online meal ordering system.

**Figure 14: Planning of a new online meal ordering system**



Which strategy for user research has been used in **Figure 14**?

- A. Scenario
  - B. Use case
  - C. Personae
  - D. Classification of users
25. Which of the following research methods in user-centred design (UCD) focus on the observation of customers' user experience first-hand and is usually conducted in the user's environment?
- A. Focus groups
  - B. Affinity diagramming
  - C. Field research
  - D. Testing house



- 26.** What best describes the requirements for all stakeholders involved in making, buying, selling or handling equipment to take responsibility for minimizing the environmental, health, and safety impact at all stages of the life cycle?
- A. Decoupling
  - B. Sustainable reporting
  - C. Product stewardship
  - D. Sustainable development
- 27.** Which of the following characters best describes a person who enthusiastically adopts environmentally friendly practices as a consumer?
- A. Eco-warrior
  - B. Eco-champion
  - C. Eco-fan
  - D. Eco-phobe

28. **Figure 15** shows trash bags which are made from plant starch and are completely compostable and biodegradable.

**Figure 15: Compostable trash bag**



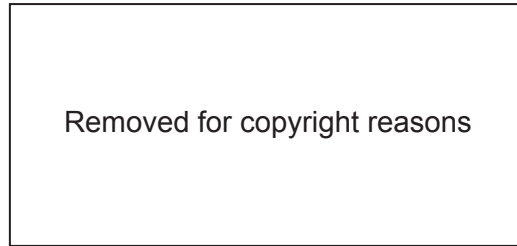
Which of Datschefski's five principles of sustainable design do the compostable trash bags, shown in **Figure 15**, best fulfil?

- A. Safe
  - B. Solar
  - C. Cyclic
  - D. Social
29. Which sustainable innovation strategy facilitates the diffusion of sustainable products and solutions into the marketplace by raising awareness to government policy holders?
- A. Energy security
  - B. Macro energy sustainability
  - C. Micro energy sustainability
  - D. Take-back legislation

- 30.** Which of the following corporate strategies presents the greatest risk for a company?
- A. Product development
  - B. Product diversification
  - C. Market development
  - D. Market penetration
- 31.** What is the term given to a broad way of categorizing the kinds of market a company is aiming for?
- A. Client sector
  - B. Market sector
  - C. Market segmentation
  - D. Target market
- 32.** A product attracting consumers on its own merit is known as a:
- A. promotion product
  - B. incremental product
  - C. trigger product
  - D. radical product

33. **Figure 16** shows the highly recognized sports brand Nike logo with words and graphic symbols.

**Figure 16: Nike “JUST DO IT.” logo**



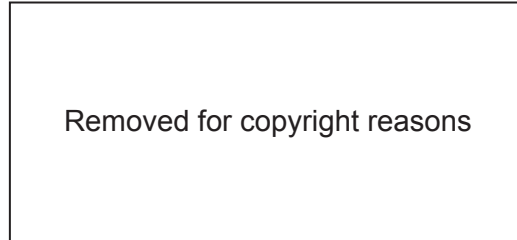
What intellectual property (IP) would need to be applied to the logo?

- A. Registered design
  - B. Copyright
  - C. Trademark
  - D. Patent
34. Which of the following is an advantage of just in case (JIC) production?
- A. Increased storage facility
  - B. Reduced inventory costs
  - C. Limited products being damaged
  - D. Ability to respond quickly to a demand for a product
35. Which of the following would benefit a company from using computer integrated manufacturing (CIM)?
- I. Suitable for smaller plants employing non-repetitive and specialised manufacturing operations
  - II. Flexible system and easy to set the automation of production
  - III. Suitable for batch production where repetitive patterns or operations occur
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

Questions 36–40 relate to the following case study. Please read the case study carefully and answer the questions.

The Life Saving Dot is similar to a bindi. It is a self-adhesive dot containing iodine, see **Figure 17**. The Life Saving Dot is a patch used to transfer iodine through the skin.

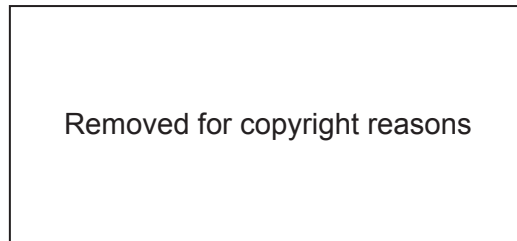
**Figure 17: The Life Saving Dot**



Iodine Deficiency Disorder (IDD) is the leading cause of preventable brain damage worldwide. In rural India, IDD is caused by a lack of iodine in the soil which prevents it from entering people’s diets. IDD particularly impacts women and can cause headaches, pregnancy complications, and breast cancer. The Life Saving Dot is a solution to this need.

Developed by the charitable foundation of advertising firm Grey Group Singapore, the Life Saving Dot provides the wearer with 150 to 200 micrograms of iodine when worn for at least four hours, see **Figure 18**.

**Figure 18: The Life Saving Dot**



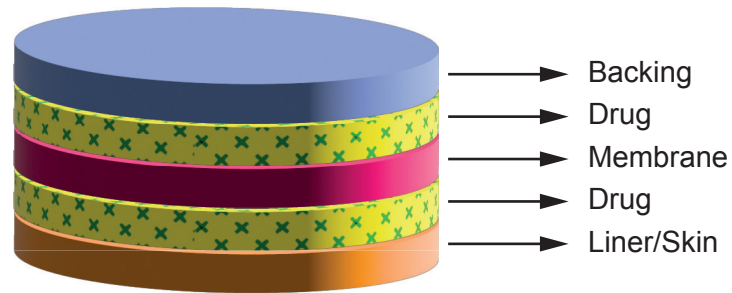
The Life Saving Dot was developed to be a low-tech solution that can be distributed efficiently to rural and disadvantaged Indian communities. By using the bindi, Grey Group hopes it is easier for users to adapt to this product, as the user does not need to change their normal behaviour. The Life Saving Dot comes in a variety of colours. The packaging and subsequent advertising campaign are designed to educate people about the issue and impacts of IDD, see **Figure 19**.

**Figure 19: Advertising campaign for the Life Saving Dot**



The skin patch consists of a layer of polymer, a matrix holding the drug, and a skin-safe adhesive, see **Figure 20**.

**Figure 20: The composition of the Life Saving Dot**



Patches like The Life Saving Dot need to be made from a material that is water resistant and durable enough to be easily applied and removed from the skin.

36. The graphical model in **Figure 20** is an example of...
- A. A 3D graphical model
  - B. A perspective drawing
  - C. An assembly drawing
  - D. A conceptual model
37. What is true of the composite materials of patches like The Life Saving Dot?
- A. They are easy to recycle
  - B. They have a reduced environmental impact
  - C. They are modified to have specific properties
  - D. They are designed to be mass customized

- 38.** Which innovation strategy did the Grey Group use?
- A. Architectural innovation
  - B. Modular innovation
  - C. Configurational innovation
  - D. Process innovation
- 39.** Which of Rogers' characteristics of innovation has Grey Group used in its marketing?
- I. Trialability
  - II. Observability
  - III. Compatibility
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
- 40.** Advertising firm, Grey Group developed The Life Saving Dot as part of their charitable foundation. Which strategy is this?
- A. Hybrid approach
  - B. Corporate social responsibility
  - C. Product development
  - D. Pioneering strategy
-



**Disclaimer:**

Content used in IB assessments is taken from authentic, third-party sources. The views expressed within them belong to their individual authors and/or publishers and do not necessarily reflect the views of the IB.

**References:**

- Figure 2** With permission from BMW Group.
- Figure 3** Image with permission from Henkel.
- Figure 4** Jim Merithew, Wired, © Condé Nast.
- Figure 5** With permission from Maform Design Agency.
- Figure 6** UFO Sinker, n.d. *UFO Sinker* [image online] Available at: <http://ufosinker.com/img/produkty/hruska.png> [Accessed 22 February 2023].
- Figure 7** ksrujana96. <https://openclipart.org/detail/297458/train>. Creative Commons Zero 1.0 Public Domain License <https://creativecommons.org/publicdomain/zero/1.0/>.
- Figure 8** FabricioMacedoPhotos / Pixabay.
- Figure 9** With permission from Oberon Design.
- Figure 10** Peng, <https://commons.wikimedia.org/wiki/File:Chapeauclaque.png>. Licensed under CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0/deed.en>. Image adapted.
- Figure 11** Muymuy, n.d. *USB Type-C cable* [image online] Available at: [www.gettyimages.co.uk/detail/photo/usb-typec-cable-royalty-free-image/1320810292?adppopup=true](http://www.gettyimages.co.uk/detail/photo/usb-typec-cable-royalty-free-image/1320810292?adppopup=true) [Accessed 22 February 2023].
- Figure 12** Trounce. <https://commons.wikimedia.org/wiki/File:03-BICcristal2008-03-26.jpg>. Licensed under CC BY 3.0 <https://creativecommons.org/licenses/by/3.0/deed.en>.
- Figure 15** With permission from UNNI Corporation.