

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
Standard level
Paper 1

Monday 20 May 2019 (afternoon)

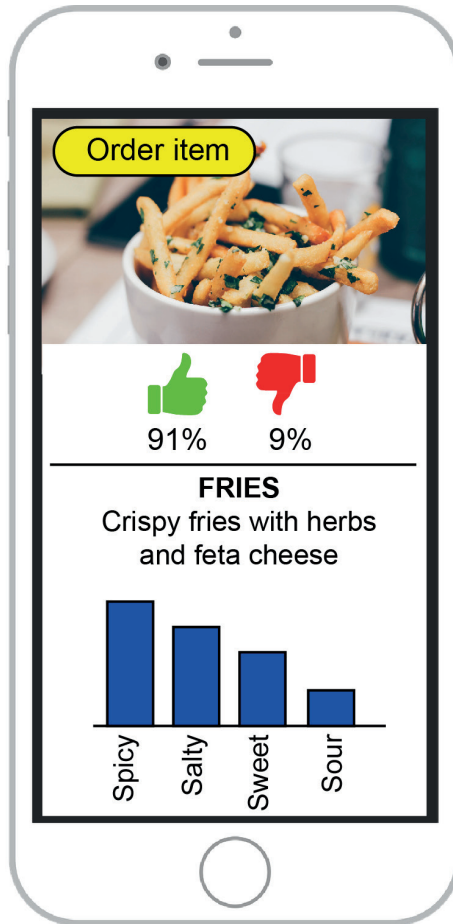
45 minutes

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 **[30 marks]**.

1. The Tasty app gathers data from customers about the meals they have chosen, see **Figure 1**.

Figure 1: The Tasty app



[Source: © International Baccalaureate Organization 2019]

What type of human factors data is the app collecting?

- A. Quantitative primary data
 - B. Quantitative secondary data
 - C. Qualitative primary data
 - D. Qualitative secondary data
2. In which scale is the order of the values important, but the differences between the values unimportant?
- A. Ordinal
 - B. Nominal
 - C. Interval
 - D. Ratio

3. What would be the likely physiological consequences of working in an environment that is too warm?
- A. Increased heart rate **and** increased performance
 - B. Increased heart rate **and** decreased performance
 - C. Drowsiness **and** increased performance
 - D. Decreased heart rate **and** decreased performance
4. If you were designing a bottle screw top to allow for easy operation, which percentile would you be designing for?
- A. 5th–50th percentile
 - B. 95th percentile
 - C. 5th percentile
 - D. 50th–95th percentile

5. The Eco-Flex straw by Aardvark Straws is biodegradable, compostable and 100% chlorine free, see **Figure 2**. Aardvark Straws claim that they are the only paper straws on the market made with FDA food grade-approved inks and paper.

Figure 2: The Eco-Flex straw



[Source: Images provided with kind permission from Hoffmaster/Aardvark Straws]

Many companies are now replacing plastic throwaway products with eco-friendly alternatives. What is the main driver for green design in products such as the Eco-Flex straw?

- A. Consumer pressure
- B. Technology push
- C. Technology pull
- D. Obsolescence

6. Which three categories are focussed on in eco-design?
- A. Materials, energy and pollution/waste
 - B. Production, utilization and distribution
 - C. Price, quality and service
 - D. Product, place and price
7. Which of the following resources is renewable?
- A. Oil
 - B. Gas
 - C. Biomass
 - D. Coal
8. Which of the following battery types is the most efficient?
- A. Lithium
 - B. Lead acid
 - C. Hydrogen fuel cell
 - D. NiCad
9. As an energy generation process, CHP (Combined Heat and Power) is fuel neutral. What does this mean?
- A. It can clean fuels
 - B. It can neutralise fuels
 - C. It can be applied to renewable and fossil fuels
 - D. It can take subsidies from fossil fuels

10. Which of the following is true of dematerialization:
- I. It reduces raw materials at the production stage
 - II. It reduces waste at the disposal stage
 - III. It reduces energy and material inputs at the use stage
- A. I and II
 - B. I and III
 - C. II and III
 - D. I, II and III

11. Wind turbines, solar cells and lithium batteries convert energy. Which of the following is the correct conversion for solar power?

	Input	Output
A.	Mechanical	Electric
B.	Electric	Radiation
C.	Radiation	Electric
D.	Electric	Mechanical

12. The paper bone chair by Joris Laarman for Droog is an early study of the internationally acclaimed aluminum bone chair. The paper bone chair was made using an early rapid prototyping technique from layers of paper, see **Figure 3**.

Figure 3: The paper bone chair



[Source: image provided with permission from Joris Laarman]

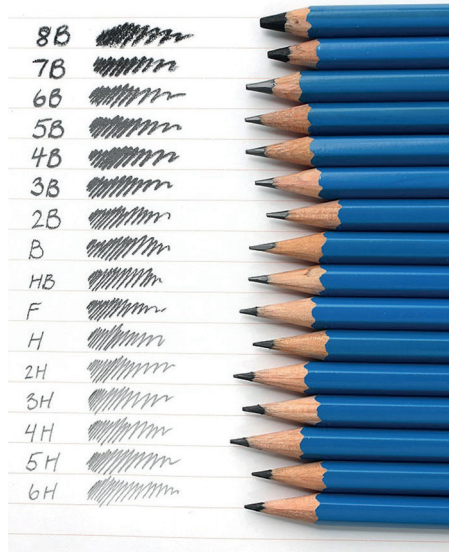
What is the rapid prototyping technique called?

- A. Fused deposition modelling (FDM)
- B. Laminated object manufacturing (LOM)
- C. Stereo-lithography
- D. Selective laser sintering (SLS)

- 13.** Graphical models are useful for engineers, manufacturers, designers and clients, and vary depending on the context. Which of the following graphical models is most appropriate in the context of an architectural design to present to a client?
- A. Assembly drawing
 - B. Perspective drawing
 - C. Isometric drawing
 - D. Orthographic projection
- 14.** Selective laser sintering can use a range of powdered materials to create products. These materials include...
- A. Plastic, metal and glass
 - B. Ceramics, textiles and wood
 - C. Plastic, wood and composites
 - D. Metal, textiles and ceramics

15. The Staedtler 100 Mars Lumograph pencil is a premium quality drawing pencil for writing, drawing and sketching, see **Figure 4**.

Figure 4: The Staedtler 100 Mars Lumograph pencil



[Source: image provided with permission from STAEDTLER]

A common wood used to make a pencil is cedar. Which type of wood is cedar?

- A. Composite wood
 - B. Soft wood
 - C. Plywood
 - D. Hardwood
16. Robots can be used to replace humans in a number of production areas. Which of the following is a potential disadvantage of using robots in production?
- A. Perform repetitive tasks
 - B. Work in confined spaces
 - C. Loss of jobs
 - D. Highly accurate

17. Which of the following best describes the term *brittle*?
- A. Returns to its original shape after being deformed
 - B. Can be drawn or extruded into an extended shape
 - C. Slow and permanent deformation under the influence of mechanical stress
 - D. Breaks into numerous sharp shards
18. Timber often needs to be treated and finished. Which of the following is a reason for treating and finishing woods with creosote?
- A. Improves chemical resistance
 - B. Reduces attack from borers, wood lice and fungal attack
 - C. Protects from the weather
 - D. Improves humidity
19. Which of the following is true of a thermosetting plastic?
- A. Ductile
 - B. High stiffness
 - C. Low stiffness
 - D. Easily reshaped after heating
20. Which of the following is a heat treating process?
- A. Tempering
 - B. Warping
 - C. Seasoning
 - D. Felting

21. Natural textile fibres are animal and plant based. Which of the following are properties of natural fibres?
- A. High absorbency: Burns with a flame, but does not melt
 - B. Low absorbency: Melts when heated
 - C. High absorbency: Melts when heated
 - D. Low absorbency: Burns with a flame, but does not melt
22. Metals and metallic alloys are easily recyclable. Which of the following is an example of an alloy?
- A. Concrete
 - B. Mild steel
 - C. Iron
 - D. Carbon fibre

23. In 1826, John Walker noticed a dried lump on the end of a stick while he was stirring a mix of chemicals. When he tried to scrape it off it created sparks and a flame. Following on from this discovery, Walker marketed the first friction matches as “Friction Lights” and sold them at his pharmacy, see **Figure 5**.

Figure 5: The “Friction Lights” match



[Source: image provided with permission from Preston Park Museum & Grounds]

Which of the following innovation strategies applies to John Walker’s invention?

- A. Adaptation
 - B. Constructive discontent
 - C. Chance
 - D. Technology transfer
24. Which of the following are innovation strategies?
- I. Market pull and technology push
 - II. Property recovery and waste mitigation
 - III. Act of insight and analogy
- A. I and II
 - B. I and III
 - C. II and III
 - D. I, II and III

25. Which of the following are Intellectual Property (IP) symbols?

- I. ™
 - II. ®
 - III. ©
- A. I and II
 - B. I and III
 - C. II and III
 - D. I, II and III

26. The 501 shrink-to-fit denim jeans is an iconic design, see **Figure 6**. In 2016, Levi's decided to update the 501 and introduce stretch denim. This change was not popular with customers who had purchased shrink-to-fit denim.

Figure 6: The Levi's 501

Removed for copyright reasons

Which of the following characteristics of classic design is shrink-to-fit denim most likely to apply to?

- A. Timeless
- B. Mass production
- C. Image
- D. Dominant design

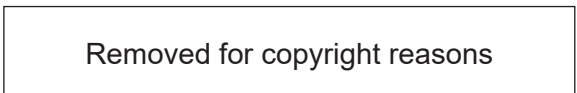
Questions 27–30 relate to the following case study. Please read the case study carefully and answer the questions.



Figure 7: 3D printed headphone cup before the gloss paint finish is applied



Figure 8: A close-up of the partially printed headphone cup showing the internal fine lattice profile and the finished headphone



27. Which of the following is a reason why Alpha Dog headphones are manufactured using 3D printing techniques?
- A. Speed of manufacture
 - B. Ergonomics of the headphones
 - C. Complex shape of the headphones
 - D. Minimize costs
28. Which of the following scales of production would be most appropriate for the Alpha Dog headphones?
- A. Craft production
 - B. Mass production
 - C. Mass customization
 - D. Batch production
29. Which of the following is the designer Dan Clark an example of?
- I. Lone inventor
 - II. Product champion
 - III. Entrepreneur
- A. I and II
 - B. I and III
 - C. II and III
 - D. I, II and III
30. Which of the following plastics would be most appropriate for 3D printing the headphone cup?
- A. Melamine resin
 - B. Poly-vinyl chloride (PVC)
 - C. Polypropylene (PP)
 - D. Acrylonitrile-Butadiene-Styrene (ABS)
-