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Design technology
Standard level
Paper 1

Wednesday 13 November 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. A labelled image of a bicycle is shown in **Figure 1**.

Figure 1: A bicycle



[Source: <https://unsplash.com>]

Which of these bike parts most likely requires the collection of dynamic data rather than static data?

- A. Seat length
 - B. Handlebar grip width
 - C. Crank length
 - D. Pedal width
2. Which percentile would be used to calculate the width of a cinema seat?
- A. 5th percentile
 - B. 5th–95th percentile
 - C. 95th percentile
 - D. 50th percentile
3. Which of the following terms refers to the physical space between two objects?
- A. Clearance
 - B. Reach
 - C. Adjustability
 - D. Percentile ranges

- 4. Which method of collecting physiological factor data is the most appropriate when asking users to rate the comfort levels of different beds?
 - A. Ratio
 - B. Nominal
 - C. Interval
 - D. Ordinal

- 5. Internet-ready televisions allow access to a number of services including film and television content, internet browsing, social media, cloud photo and file storage and a host of other apps, see **Figure 2**.

Figure 2: An internet-ready television



What is an internet-ready television an example of?

- A. Radical solution
- B. Green design
- C. Converging technology
- D. "Design for the environment" software

6. If waste created from an obsolete product is used as a resource again and again in a closed loop system, which waste mitigation strategy is this an example of?
- A. Repair
 - B. Circular economy
 - C. Cradle to grave
 - D. Dematerialization
7. Which of the following are considered when carrying out a life cycle analysis (LCA)?
- I. Utilization
 - II. Disposal
 - III. Amount of labour
- A. I and II
 - B. I and III
 - C. II and III
 - D. I, II and III
8. Resources that can be identified in terms of quantity and quality are known as...
- A. Non-renewable resources
 - B. Reserves
 - C. Recyclables
 - D. Renewable resources
9. Which of the following are drivers for cleaning up manufacturing?
- I. Promoting positive impacts
 - II. Reducing wastage of energy
 - III. Desire to make money
- A. I and II
 - B. I and III
 - C. II and III
 - D. I, II and III

10. What type of batteries are used in cell/mobile phones?
- A. Hydrogen fuel cells
 - B. NiCad
 - C. Lead acid
 - D. Lithium
11. **Figure 3** shows people in a museum. By interacting with the exhibit they are able to understand how the image displayed on the screen feels.

Figure 3: People interacting with an exhibit in a museum



[Source: image provided with kind permission from Christopher Dean]

Which technology enables the people to understand what the image feels like through their sense of touch?

- A. Animation
- B. Haptic
- C. Motion capture
- D. Virtual prototyping

- 12.** Which of the following modelling techniques would most likely be used to understand how well a new concept functions?
- A. Aesthetic model
 - B. Mock-up
 - C. Scale model
 - D. Prototype
- 13.** Which of the following would enable a designer to understand the structural forces acting on a bridge support?
- A. Data modelling
 - B. Bottom-up Modelling
 - C. Finite element analysis (FEA)
 - D. Virtual prototyping

14. The aircraft canopy of the fighter jet in **Figure 4** allows the pilot to see out while flying. It is made from a thick polycarbonate which can absorb the impact of any debris.

Figure 4: An aircraft canopy



[Source: <https://pixabay.com>]

What mechanical property does this demonstrate?

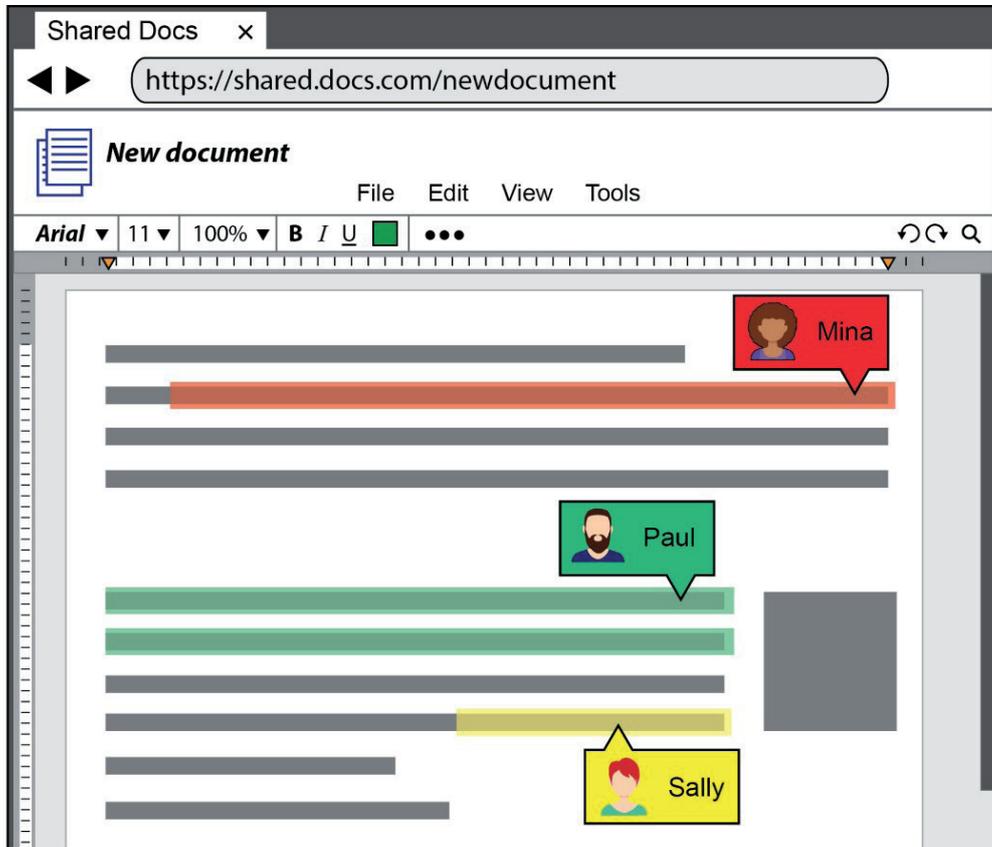
- A. Ductility
 - B. Hardness
 - C. Toughness
 - D. Plasticity
15. Sunglasses can be made using a smart material that, if deformed, will return to its original shape through the application of heat. What smart material is this describing?
- A. Shape memory alloy
 - B. Photochromic material
 - C. Piezoelectric material
 - D. Magneto-rheostatic material

16. Which of the following raw materials can be used to make plastics and bioplastics?
- I. Plant fibres (cellulose)
 - II. Crude oil
 - III. Petrol
- A. I and II
 - B. I and III
 - C. II and III
 - D. I, II and III
17. Basketball shoes can be designed by individual customers to personalize the colour and style. What scale of production is this an example of?
- A. Batch production
 - B. Mass customization
 - C. Mass production
 - D. Continuous flow
18. Grain size of metals can be controlled and modified by the rate at which metal is allowed to cool and solidify. What will the characteristics of the grains be if the metal is rapidly cooled?
- A. No grains
 - B. Large grains
 - C. Small grains
 - D. Combination of large and small grains

19. Using sandpaper/glasspaper to smooth the surface of a piece of wood is an example of...
- A. Machining
 - B. Abrading
 - C. Turning
 - D. Cutting
20. Which textile manufacturing process uses multiple loops of yarn called stitches to create items of clothing?
- A. Knitting
 - B. Felting
 - C. Weaving
 - D. Lacemaking

21. **Figure 5** shows a Shared Docs file. Instead of each user having to work on separate files, Shared Docs allows the three different collaborators to work on a single file.

Figure 5: An example of a Shared Docs file



[Source: © International Baccalaureate Organization 2019]

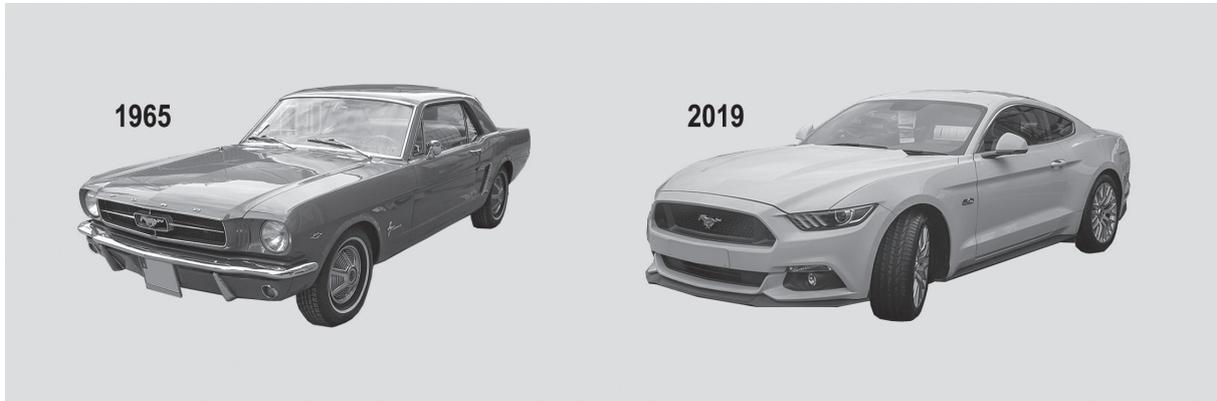
Which category of innovation is used in Shared Docs to allow collaboration with other people?

- A. Architectural innovation
- B. Modular innovation
- C. Sustaining innovation
- D. Disruptive innovation

22. Which strategy for protecting intellectual property applies to words or symbols used to represent a company?
- A. Patent
 - B. Copyright
 - C. Trademark
 - D. Registered design
23. Which of Rogers' categories of consumers best describes the group who are the first to adopt new technology, even if it is yet to be proven successful?
- A. Innovators
 - B. Laggards
 - C. Early majority
 - D. Late majority

24. **Figure 6** shows the Ford Mustang, which was first manufactured in 1965 is still being manufactured in 2019. The engineers of the new car have designed the sound of the engine to replicate the original model.

Figure 6: The Ford Mustang



[Source: adapted image (cropped and recoloured) "1965 Ford Mustang 2D Hardtop Front" by Kroelleboelle (en.wikipedia.org). Under copyright and creative commons licence 3.0 (<https://creativecommons.org/licenses/by-sa/3.0/deed.en>) and adapted image (cropped, blurred and recoloured) "2018 Ford Mustang GT 5.0 Front" by Vauxford (en.wikipedia.org). Under copyright and creative commons licence 4.0 (<https://creativecommons.org/licenses/by-sa/4.0/deed.en>)]

What is this an example of?

- A. Practical function
 - B. Psychological function
 - C. Retro styling
 - D. Conflict and compromise
25. What type of design contains features that are recognized as essential by a majority of manufacturers and purchasers?
- A. Obsolescent design
 - B. Mass produced design
 - C. Omnipresent design
 - D. Dominant design

26. Which of the following processes, commonly used in video games and animated movies, uses magnetic markers or LEDs to create a digital image of a person?
- A. Data modelling
 - B. Statistical modelling
 - C. Motion capture
 - D. Virtual prototyping

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

Puma’s new shoe packaging changes the idea of the shoebox by wrapping footwear in a simple cardboard structure held in place by a reusable bag.

Puma’s new design of shoe box is known as “Clever Little Bag” and was designed by a company led by designer Yves Béhar, see **Figure 7**.

Figure 7: An example of the Puma Clever Little Bag



[Source: images and details with kind permission from fuseproject]

Clever Little Bag contains 65% less cardboard, by using a bag made of recycled plastic as the outer layer that holds the inner cardboard structure and has no top/lid.

The bag’s handles slip through a hole at one end of the inner box, securing the bag to the cardboard and providing a plastic bag-free way to carry the shoes.

Due to using 8500 fewer tons of paper, and the new packaging’s lighter weight, Puma expects to cut carbon dioxide emissions by 10 000 tons per year and water, energy and diesel use by 60%. That works out to 1 million litres of water, 20 million megajoules of electricity, 1 million litres of fuel oil and 500 000 litres of diesel, see **Figure 8**.

Figure 8: A graphic illustrating the manufacturing process of Clever Little Bags



[Source: images and details with kind permission from fuseproject]

27. The Clever Little Bag is designed in a way where there is no need for the top of the box to hold in the shoes. Which waste mitigation strategy is this an example of?
- A. Re-use
 - B. Recycle
 - C. Dematerialization
 - D. Recondition

- 28.** Which modelling technique would the designer use to test whether the cardboard insert can be removed from the plastic sleeve easily?
- A. Graphical modelling
 - B. Surface modelling
 - C. Physical modelling
 - D. Solid modelling
- 29.** The Clever Little Bag is sent to retailers as a flat pack for assembly using slots and tabs. Which joining technique is this an example of?
- A. Temporary joining
 - B. Permanent joining
 - C. Adhering
 - D. Fusing
- 30.** Which of the following was most likely a driver for invention for the Clever Little Bag?
- A. Technical curiosity
 - B. Desire to make money
 - C. Scientific curiosity
 - D. Constructive discontent
-