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Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Standard level
Paper 1

4 November 2024

Zone A afternoon | **Zone B** afternoon | **Zone C** 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]**.

8824 – 6402
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13 pages

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1. Designers of bicycle helmets need to ensure that the products they design can be properly fitted for a wide range of users see **Figure 1**.

Figure 1: Bicycle helmet

What is the main consideration when designing a bicycle helmet to be properly fitted?

A. Dynamic data

B. Range of sizes

C. Adjustability

D. Static data

2. Which of the following is a method of collecting psychological factor data?

A. Database

B. Observation

C. Calipers

D. Measuring Tape

3. What affects the reliability of psychological factor data?

A. Perception

B. Alertness

C. Comfort

D. Fatigue

4. Which data scale could be used to gather feedback from users about the comfort of a product?

A. Ordinal

B. Interval

C. Ratio

D. Nominal

5. What is a disadvantage of nuclear energy?

A. Low efficiency

B. CO_2 emissions

C. Decommissioning cost

D. Inconsistent supply

6. Which of the following can be a system for individual energy generation?

I. Solar photovoltaic
II. Biomass system
III. Wind turbines

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

7. A circular economy is an example of what?

A. Incremental solution

B. System level solution

C. End-of-pipe

D. International legislation

8. Life cycle analysis (LCA) allows a product's impact on the environment to be assessed at each stage of its life cycle.

Which life cycle system is LCA used to assess?

A. Cradle to cradle

B. Cradle to grave

C. Grave to cradle

D. Grave to grave

9. Environmental legislation is often based on the precautionary principle or the preventative principle.

What distinguishes the precautionary principle from the prevention principle?

A. Lack of scientific certainty

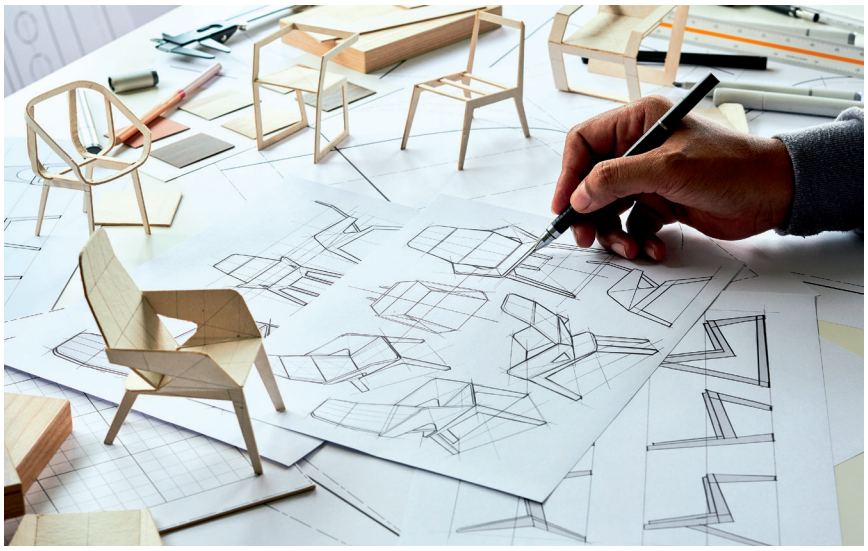
B. Minimized damage to the environment

C. Based on known dangers

D. Risk of damage can be easily predicted

10. **Figure 2** shows a scale model of a chair.

Figure 2: A scale model of a chair



What is the purpose of using scale models?

A. Ease of visualization

B. To minimize waste

C. Ease of testing the function

D. To measure the level of performance

11. What type of graphical model gives the **most** realistic representation of an object?

A. Isometric

B. Orthographic

C. Scale drawing

D. Perspective

12. Digital humans can be used in various ways to help the development of a design.

Digital humans are created using:

A. Virtual reality (VR)

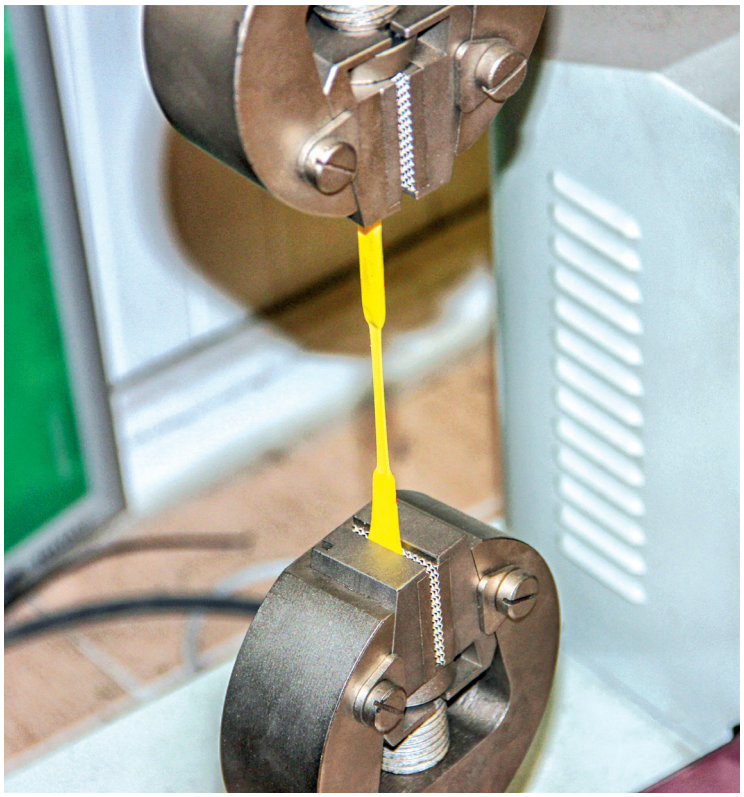
B. Haptic technology

C. Motion capture

D. Animation

13. **Figure 3** shows a test for Young's modulus where a material is being stretched.

Figure 3: A test for Young's modulus



Which material property is being tested?

A. Thermal expansion

B. Strain

C. Hardness

D. Toughness

14. What characteristic of laminated glass makes it safe for users?

A. It is heat treated

B. It is finished with a coating

C. It has a crystalline structure

D. It contains an adhesive layer

15. Which combination of environmental conditions would cause bio-plastics to degrade?

A. Sunlight, dampness, bacteria

B. Heat, dampness, sunlight

C. Sunlight, bacteria, heat

D. Heat, bacteria, dampness

16. What acts as the binding agent in composites?

A. Particles

B. Fibres

C. Matrix

D. Sheet

17. Which scales of production allows the user control over the look and feel of the final product?

I. Batch
II. Mass customization
III. One-off

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

18. Which manufacturing processes can be used to shape composites?

I. Moulding
II. Weaving
III. Casting

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

19. What is an advantage of single-task robots over multi-task robots?

A. They have machine to machine (M2M) capabilities

B. They can work in teams

C. They have a larger work envelope

D. They can reliably perform one specific job

20. **Figure 4** shows the interior of an Apple Store.

Figure 4: The interior of an Apple Store

Which of Rogers' characteristics of innovation is demonstrated in the Apple Store?

A. Relative advantage

B. Trialability

C. Observability

D. Complexity

21. Why would a company use a trademark to protect their intellectual property (IP)?

A. For exclusive rights to the use and distribution of creative works

B. For the right to make or sell a new invention for a certain number of years

C. To legally register an image, symbol or word(s) which represent the company or product

D. To notify those copying the invention that they may be liable for damages

22. Which strategy for innovation takes inspiration from nature?

A. Analogy

B. Adaptation

C. Act of insight

D. Market pull

23. At which stage of the product life cycle is the greatest investment required?

A. Launch

B. Growth

C. Maturity

D. Decline

24. Which characteristic of the Monobloc chair, see **Figure 5**, most contributes to its classic design status?

Figure 5: The Monobloc chair

A. Nostalgia

B. Status

C. Style

D. Ubiquitous

25. When retro-styling a product, which of the following should be considered?

A. The original form

B. Practical function

C. Psychological function

D. Conflict and compromise

26. **Figure 6** shows the Prudential Building in New York which is considered as an example of "form follows function".

Figure 6: The Prudential Building

Which of the following best describes the principle of "form follows function"?

A. Designers develop new technologies to blur the lines between form and function

B. Practical function and psychological function should be balanced

C. The form of a product should be determined by its function

D. There is tension between form and function

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

Stilride was founded in 2019 and began developing electro-mobility devices based on industrial origami using high-strength stainless steel, see **Figure 7**.

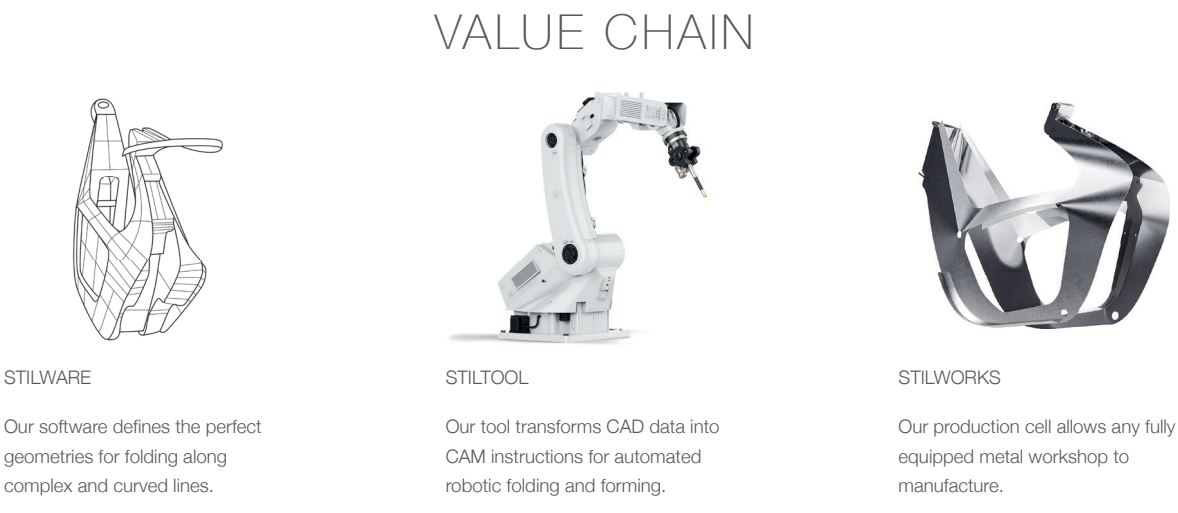
Figure 7: A Stilride motorbike

The manufacturing technique uses lasers to apply highly localized heat treatment to temper-rolled stainless steel. It focuses on softening areas where material will need to bend. Robots then form the temper-rolled sheets into complex 3D shapes.

The advantages of this are a 40 % reduction in weight, 70 % fewer components, 20 % lower material costs and 25 % lower labour costs.

Stilride supplies software, tools and materials so that its e-bike can be made anywhere, see **Figure 8**.

Figure 8: Stilride software, tools and materials



27. By folding stainless steel sheets Stilride has resulted in a 40 % reduction in weight and 70 % fewer components. What waste mitigation strategy is this?

A. Reconditioning

B. Circular economy

C. Dematerialization

D. End-of-pipe

28. In what way does tempering the stainless steel change its properties?

A.	Increases toughness	Decreases hardness
B.	Increases toughness	Increases hardness
C.	Decreases toughness	Decreases hardness
D.	Decreases toughness	Increases hardness

29. Which of the following best describes the manufacturing processes for the body of the Stilride?

A.	Wasting/subtractive	Shaping techniques
B.	Wasting/subtractive	Joining techniques
C.	Additive techniques	Shaping techniques
D.	Additive techniques	Joining techniques

30. Robots bend the stainless steel sheets that form the body of the Stilride e-bike.

Which category of innovation is this?

A. Architectural innovation

B. Modular innovation

C. Configurational innovation

D. Process innovation

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References:

Figure 1 SolStock, 2018. *Adjusting a Cycle Helmet Light – stock photo* [image online] Available at: https://www.gettyimages.co.uk/detail/photo/adjusting-a-cycle-helmet-light-royalty-free-image/886639216 [Accessed 27 November 2023].

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Figure 3 Funtay, 2021. *Test of polyethylene – stock photo* [image online] Available at: https://www.gettyimages.co.uk/detail/photo/tensile-test-of-the-polyethylene-the-most-common-royalty-free-image/1319615328?phrase=Tensile+testing&adppopup=true [Accessed 23 November 2023].

Figure 4 °Florian. Apple Store, Opéra. https://commons.wikimedia.org/wiki/File:Apple_Store,_Op%C3%A9ra_1.jpg. Licensed under CC BY-SA 2.0 https://creativecommons.org/licenses/by-sa/2.0/deed.en.

Figure 5 I'm love photography and art. This is me., 2022. *White monobloc plastic chairs isolated on white background…* [image online] Available at: https://www.gettyimages.co.uk/detail/photo/white-monobloc-plastic-chairs-isolated-on-white-royalty-free-image/1443848481?phrase=Monobloc+chair&adppopup=true [Accessed 23 November 2023]. Source adapted.

Figure 6 w_lemay. Guaranty (Prudential) Building, Church Street and Pearl Street, Buffalo, NY. https://en.wikipedia.org/wiki/Prudential_%28Guaranty%29_Building. Licenced under Creative Commons CC BY-SA 2.0 https://creativecommons.org/licenses/by-sa/2.0/deed.en.

Figure 7 With permission from Stilride Sweden AB.

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