Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Higher level
Paper 1

4 November 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]**.

8824 – 6401

19 pages

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. Which environmental factor has the least effect on workplace performance?

A. Light

B. Temperature

C. Sound

D. Texture

4. What is a disadvantage of nuclear energy?

A. Low efficiency

B. CO_2 emissions

C. Decommissioning cost

D. Inconsistent supply

5. 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

6. Many cities have introduced environmental legislation focused on reducing plastic waste.

Who is most responsible for monitoring compliance of this legislation?

A. Local government agencies

B. Consumer pressure groups

C. Non-governmental organizations (NGOs)

D. Manufacturers

7. At which stage of the product life cycle does “design for the environment” software provide unreliable data?

A. Pre-production

B. Distribution

C. Utilization

D. Disposal

8. To identify areas for improvement, manufacturers evaluate the amount of toxic chemicals in their products.

Which environmental category does this address?

I. Materials

II. Energy

III. Pollution/waste

A. I and II only

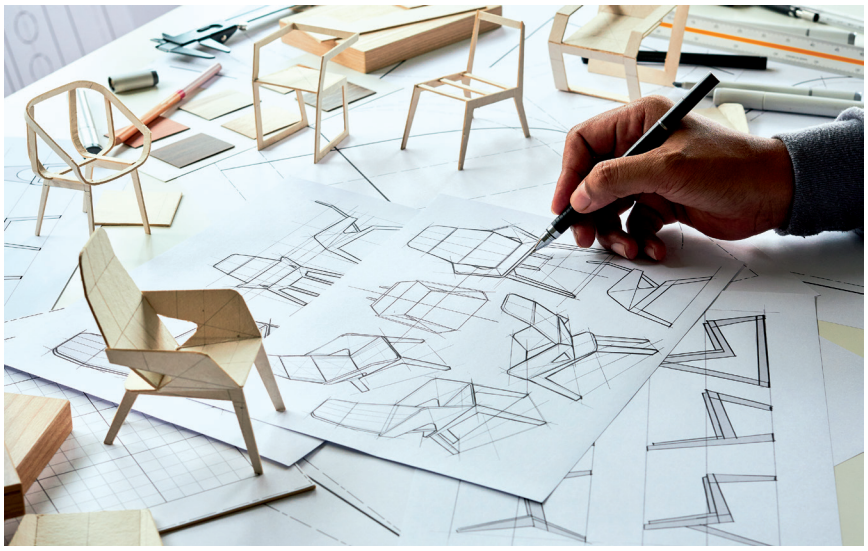
B. I and III only

C. II and III only

D. I, II and III

9. **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

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

A. Isometric

B. Orthographic

C. Scale drawing

D. Perspective

11. What is the key consideration for users in the design of an information system for mass-customization?

A. Maintenance

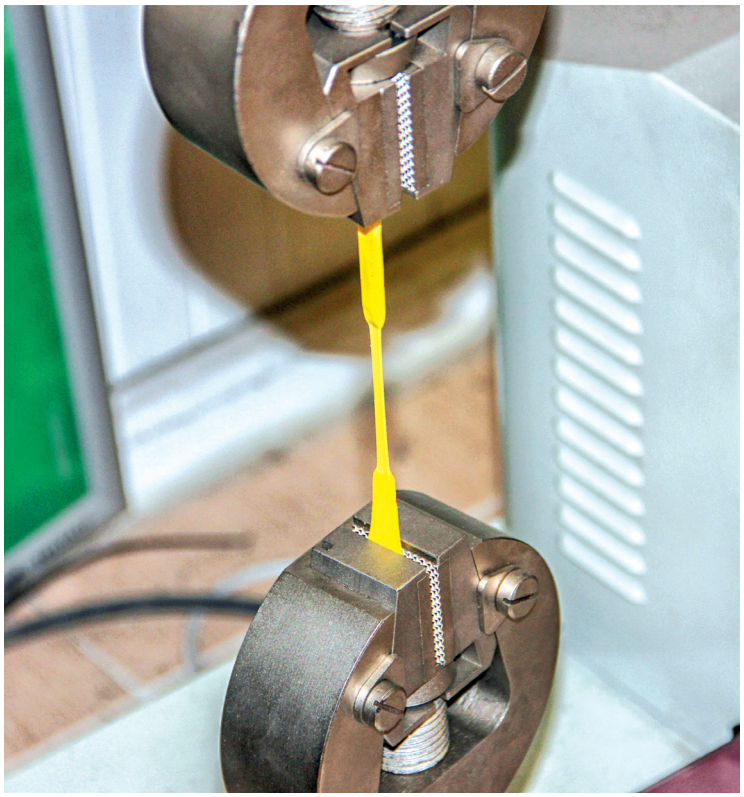
B. Quality control

C. Product interface

D. Safety

12. **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

13. 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

14. Which combination of environmental conditions would cause bioplastics to degrade?

A. Sunlight, dampness, bacteria

B. Heat, dampness, sunlight

C. Sunlight, bacteria, heat

D. Heat, bacteria, dampness

15. When selecting craft production as a production system, what are the most important criteria?

A. Environmental impact, skills, type of product

B. Labour, skills, type of product

C. Labour, type of product, environmental impact

D. Environmental impact, labour, skills

16. What is a potential disadvantage of using third-generation robots in automated production?

A. Lack of flexibility

B. Increased waste and pollution

C. Loss of jobs

D. Requirement of training

17. **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

18. 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

19. Which of the following best describes the role of the inventor?

A. An individual with a defined position within a multidisciplinary team

B. An influential individual who can take an invention to market

C. An influential individual who usually works within an organization

D. An individual who is committed to the invention of a novel product

20. 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

21. 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

22. When British Airways developed a new collection of uniforms, the designer Ozwald Boateng observed a number of employees to understand what they needed from their uniform when completing various tasks, see **Figure 6**.

Figure 6: The new British Airways uniform

[Source: BRITISH AIRWAYS' NEW UNIFORM. https://mediacentre.britishairways.com/image/details/152304. With permission from British Airways.]

Which user-centred design (UCD) approach does this best describe?

A. Empathetic

B. Personae

C. Stewardship

D. Field trial

23. Interface designers will often present paper prototypes to clients or users for feedback. What is this strategy known as?

A. Affinity diagramming

B. Participatory design

C. Methods of extreme

D. Perceptual mapping

24. Which one of the following terms relates to a product's function in the ACT model?

A. Attract

B. Aesthetics

C. Converse

D. Transact

25. Using its F.L.X. (future-led execution) technology, Levi's is bringing back vintage jeans using contemporary technology, while reducing water wastage and combating overproduction.

Traditional finishes were 18–20 steps and used chemicals and water. F.L.X. is three steps: they create a base, mark with a laser, and then post wash. See **Figure 7**.

Levi's is using resources more productively and redesigning production systems, while still delivering the same or equivalent goods and services with lower environmental impact.

Figure 7: Levi's jeans being marked with a laser

Which sustainable development approach is Levi's using?

A. Sustainability reporting

B. Dematerialization

C. Decoupling

D. Bottom-up

26. Datschefski's five principles of sustainable design are cyclic, solar, safe, efficient, and social.

Which of the following best describes cyclic?

A. Product manufacture and use supports basic human rights

B. Enhances cultural diversity

C. Compostable, organic materials

D. Does not harm other people or life

27. Which is an example of macro energy generation?

A. Hydroelectric power

B. Water heating panels

C. Roof mounted solar power

D. Wearable thermoelectric materials

28. Sustainability reporting is a company report which focusses on which of the following performance aspects?

I. Governance

II. Environmental

III. Economical

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

29. Oatly has been selling oat-based milk since the 1990s, which has been branded as Oatly since 2001, see **Figure 8**.

Glebe Farm Foods specializes in the production of certified, 100 % gluten-free oats. It launched an oat drink in January 2019. Originally simply called Oat Drink, it was rebranded as PureOaty (a play on the word “purity”) a year later, with updated product packaging.

Following this rebrand, Oatly bought legal action against Glebe Farm Foods in the IPEC (Intellectual Property Enterprise Court).

Figure 8: Oatly packaging

Oatly objected to PureOaty using the word oat on its carton, as it distinguishes the company’s product from competitors. What IP protection was it claiming infringement on?

A. Imitative strategy

B. Brand Identity

C. Trademark

D. Registered design

30. Consumer market segments include which of the following characteristics?

I. Income, profession, age

II. Product, price, income

III. Family, values, behaviour

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

31. What would be a disadvantage of perceptual mapping?

A. Quantitative data

B. Quick to construct

C. Subjective/biased

D. Identifies gaps

32. Product standardization refers to uniform or shared characteristics of a product.

Which type of product standardization would shoe sizes apply to?

A. Government standards

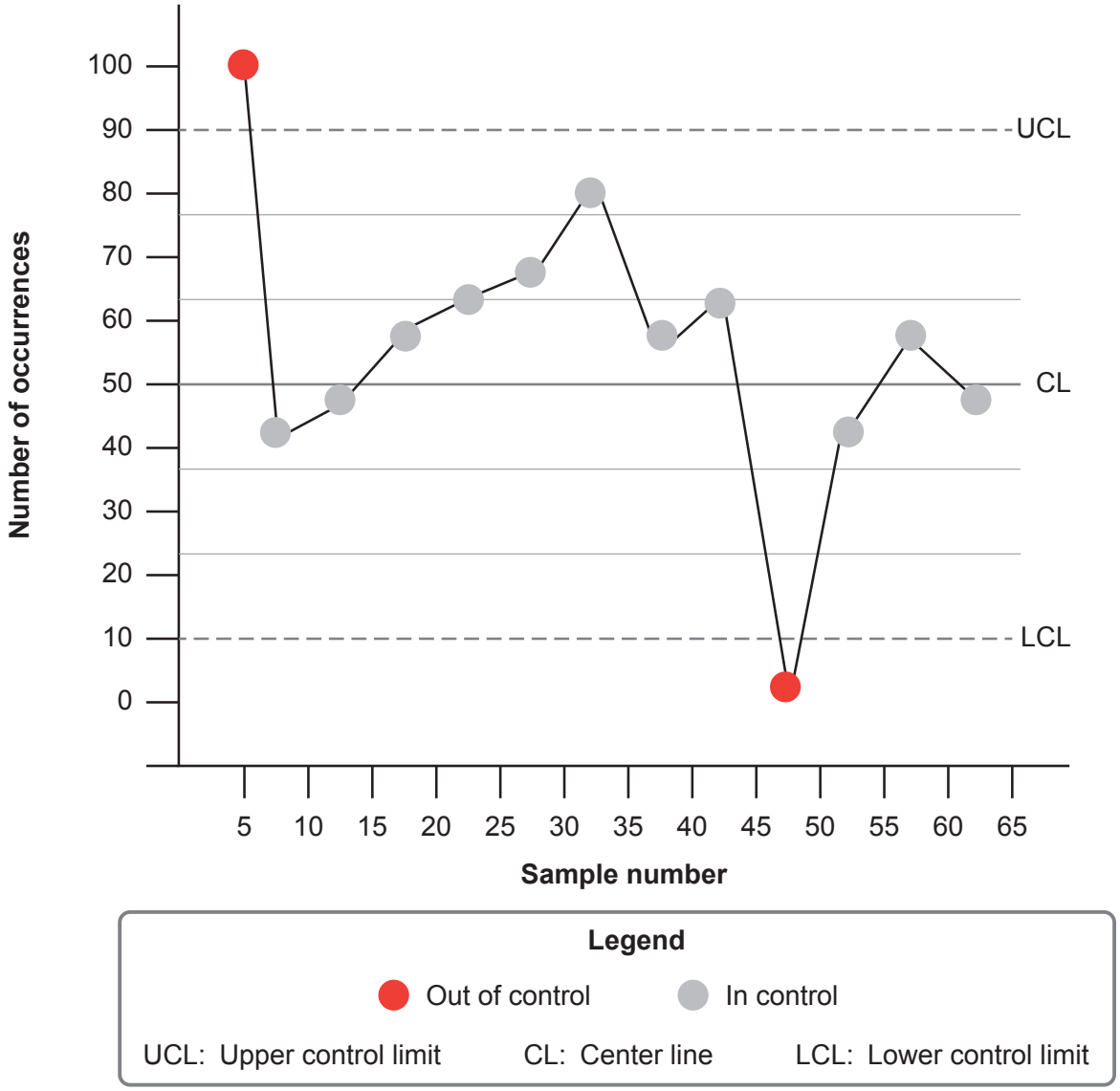
B. Component standards

C. Industry standards

D. System standards

33. Statistical process control (SPC) is a quality control tool that uses statistics to monitor processes, see **Figure 9**.

Figure 9: An example of information provided by SPC



[Source: With permission from Lucid Software Inc.]

Which of the following are benefits of statistical process control (SPC)?

I. Reduce waste
II. Increase efficiency
III. Detect defects

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

34. Which of the following is a disadvantage of computer integrated manufacturing (CIM)?

A. Increases maintenance costs

B. Increases return on investment

C. Reduces lead time

D. Reduces machine downtime

35. Which of the following describes when a product is sold for consumption?

A. Wholesale price

B. Retail price

C. Manufacturing price

D. Fixed price

Questions 36–40 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 10**.

Figure 10: 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 11**.

Figure 11: Stilride software, tools and materials

36. 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

37. 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

38. Which of the following best describes the manufacture 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

39. 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

40. Stilride aims to reduce the product's carbon footprint by supplying software, tools and materials so that any metal workshop can manufacture the product. In what way does this apply to the 7 wastes in lean manufacturing?

A. Transporting and over-production

B. Inventory and waiting

C. Waiting and over-production

D. Transporting and sorting

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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].

LeoPatrizi, 2020. *Woman putting helmet on and ready to ride – stock photo* [image online] Available at: https://www.gettyimages.co.uk/detail/photo/woman-putting-helmet-on-and-ready-to-ride-royalty-free-image/1264139699 [Accessed 27 November 2023].

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Figure 2 Chaosamran_Studio, 2022. *Designer sketching drawing design development… – stock photo* [image online] Available at: https://www.gettyimages.co.uk/detail/photo/designer-sketching-drawing-design-development-royalty-free-image/1406509392?phrase=Designing%2Ba%2Bchair [Accessed 23 November 2023].

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 BRITISH AIRWAYS' NEW UNIFORM. https://mediacentre.britishairways.com/image/details/152304. With permission from British Airways.

Figure 8 With permission from Ruth Holroyd.

Figure 9 With permission from Lucid Software Inc.

Figure 10 With permission from Stilride Sweden AB.

Figure 11 With permission from Stilride Sweden AB.