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# Design technology

## Higher level

### Paper 1

11 May 2023

Zone A afternoon | Zone B morning | Zone C afternoon

1 hour

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#### 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. Advances in 3D printing have led to lighter and more aesthetic prosthetic products, see **Figure 1**.

**Figure 1: A 3D printed prosthetic product**



Which human factors were considered by the designer?

- I. Physiological factors
  - II. Psychological factors
  - III. Aesthetic factors
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
2. A designer would label items by name using...
    - A. a ratio scale.
    - B. an ordinal scale.
    - C. a nominal scale.
    - D. an interval scale.

3. Which of the following is an example of dynamic data?
- A. Measuring the height of a person using a stadiometer
  - B. Measuring the body fat composition of an athlete
  - C. Measuring the steps of a person while walking
  - D. Measuring the weight of a person using scales
4. The company *Remade* collects old smartphones and rebuilds them so they perform as new before reselling them, see **Figure 2**.

**Figure 2: Rebuilt smartphones**



What waste mitigation strategy is being employed by the company?

- A. Re-engineering
- B. Recycling
- C. Re-using
- D. Reconditioning

5. Which of the following are reasons why radical solutions for waste mitigation are unlikely to be adopted by organizations?
- I. Success is not guaranteed
  - II. Requires considerable research and development
  - III. Time consuming
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
6. What best describes the embodied energy of a product?
- A. The total energy required to use the product
  - B. The total energy needed to dispose and recycle the product
  - C. The total energy required to produce the product
  - D. The total energy associated with the distribution of the product
7. Which of the following are examples of an end-of-pipe process that reduces the problem of carbon dioxide (CO<sub>2</sub>) emissions?
- I. CO<sub>2</sub> capture by the use of filters
  - II. CO<sub>2</sub> capture by replanting forests
  - III. CO<sub>2</sub> capture in chimneys
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

8. The Simodont® Dental Trainer is a device used by university students to practice surgery skills during their dentistry training, see **Figure 3**. The device uses sensors that measure forces exerted by the user on the interface and recreates a sense of touch.

**Figure 3: The Simodont® Dental Trainer**



What name is given to this type of technology?

- A. Motion capture
  - B. Virtual reality
  - C. Haptic technology
  - D. Augmented reality
9. Prototyping objects using plastic powder deposition is known as...
- A. laminated object manufacturing (LOM).
  - B. fused deposition modelling (FDM).
  - C. stereolithography.
  - D. selective laser sintering (SLS).

10. Which of the following provide data about the external components of a product?

- I. Surface model
- II. Aesthetic model
- III. Scale model

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

11. A material that generates electricity when it is compressed...

- A. is electro-rheostatic
- B. is piezo-electric
- C. is thermos-electric
- D. has shape memory

12. Polyester fibre is used in the manufacturing of seatbelts in cars due to its high...

- A. stiffness.
- B. elasticity.
- C. tensile strength.
- D. viscosity.

13. Super alloys are used for medical implants.

Why are super alloys used for this purpose?

- I. Surface stability
- II. High corrosion resistance
- III. Has thermal creep

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

14. Which property allows a material to be drawn into thin wires without breaking?

- A. Plasticity
- B. Elasticity
- C. Ductility
- D. Malleability

- 15.** Seamless thermoplastic water tanks are usually produced using the process of...
- A. plastic deposition.
  - B. plastic fusion.
  - C. plastic moulding.
  - D. plastic casting.
- 16.** Which of the following products would laminated glass be used for?
- A. Drinking bottles
  - B. Car windshields
  - C. Thermometers
  - D. Laboratory test tubes

17. **Figure 4** shows IKEA's flat-pack refugee shelter. The design was developed by the not-for-profit IKEA Foundation to provide a better shelter than the usual emergency tents used in crisis locations.

**Figure 4: IKEA's flat-pack refugee shelter**



What type of driver for invention motivated the IKEA Foundation to develop this shelter?

- A. Desire for change
- B. Desire to help others
- C. Constructive discontent
- D. Desire to promote the company's image

- 18.** Which intellectual property (IP) practice is used to identify a service rather than a product?
- A. Service identity
  - B. Service patent
  - C. Service mark (SM)
  - D. Service copyright
- 19.** Which of the following is an example of qualitative data collection?
- A. Using statistical techniques to analyse data
  - B. Using a scale model to carry out comparative data analysis
  - C. Using a transcript from an interview
  - D. Using computer simulation to evaluate performance results

20. **Figure 5** shows the Silver Cross® Pram. It was first developed for the British Royal Family in 1877 and since then it has been chosen for royal babies. The Silver Cross® Pram is considered a classic design.

**Figure 5: The Silver Cross® Pram**



What has contributed to the Silver Cross® Pram being considered as a classic design?

- A. It is handmade and produced in limited edition only
  - B. It has a timeless appeal
  - C. It is very comfortable for babies
  - D. It is characterized by its luxurious design
21. Which term is used to describe a product that uses the form and decoration from a particular period of time?
- A. Revival
  - B. Retro-styling
  - C. Obsolescence
  - D. Restoration

- 22.** The concept stage is one of the five user-centred design stages.  
Which one of the statements best describes the concept stage?
- A. Brainstorming design ideas
  - B. Launching a design solution
  - C. Documenting user performance requirements
  - D. Implementing a design solution
- 23.** Which of the following statements are true about a product designed for physio-pleasure?
- I. Designed for the cognitive ability of the user
  - II. Designed for touching, smelling, hearing and tasting something
  - III. Designed for a user with limited strength
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

24. **Figure 6** shows an example of a genetically modified tomato.

**Figure 6: A genetically modified tomato**



[Source: Maryna Iaroshenko / iStock]

Genetically modified food is an example of...

- A. Rogers' innovation theory.
  - B. product sustainability.
  - C. product development.
  - D. product stewardship.
25. The following statement refers to one of Datschefski's five principles:

*"The production and use of a product which is aligned to aspects of the human rights act."*

What type of principle is this?

- A. Social
- B. Safe
- C. Effective
- D. Solar

26. The concept of energy security refers to...
- A. the infinite availability of fossil fuels.
  - B. a top-down strategy linked to the supply of energy.
  - C. a government intervention policy for macro energy sustainability.
  - D. the uninterrupted availability of energy sources at an affordable price.
27. Being an ethical consumer means buying products that:
- I. do not harm the environment and society
  - II. were ethically produced
  - III. are cheap
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
28. Which of the following best describes an eco-warrior?
- A. Individuals or groups that actively resist talk of environmental protection
  - B. Individuals or groups that champion environmental issues within organizations
  - C. Individuals or groups that actively demonstrate on environmental issues
  - D. Individuals or groups that enthusiastically adopt environmentally friendly practices as consumers
29. Which of the following are **all** examples of market segments:
- A. Behaviour, income, profession, utilities, values
  - B. Age, behaviour, income, profession, utilities
  - C. Age, income, profession, utilities, values
  - D. Age, behaviour, income, profession, values

30. A design company has produced a new brand identity for a drinks company. They have used an imitative strategy. **Figure 7** shows the new drinks bottles.

**Figure 7: A range of new drinks bottles**



[Source: Images by scanrail / iStock]

What does an imitative strategy rely on?

- A. The company's and competitor's designers working together to create a pioneered product
- B. The company using just-in-time strategies to create a similar product
- C. The company using designs of other companies to create similar designs
- D. The competitors and manufacturer working together to create a new radical product

31. **Figure 8** shows the retail prices for three products.

**Figure 8: The retail prices for three products**



What is the pricing strategy used?

- A. Psychological pricing
  - B. Product line pricing
  - C. Competitor-based pricing
  - D. Profit-based pricing
32. What is the purpose of market research?
- A. To develop a design specification
  - B. To learn about the desires of a target customer base
  - C. To make contacts during field studies
  - D. To effectively promote a brand identity

- 33.** Which of the following are characteristics of lean production?
- I. Unskilled workforce
  - II. Zero defects
  - III. Quality control (QC)
- 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 best describes workflow analysis?
- A. A focus on feedback and incremental improvement
  - B. Results in a list of potential usability issues identified
  - C. A process that breaks down human activity into smaller parts
  - D. A process to improve efficiency within the workplace
- 35.** Which of the following best describes quality assurance (QA)?
- A. Involvement in development systems to ensure that products or services are designed and produced to meet or exceed customer requirements and expectations.
  - B. A quality control tool that uses statistical methods to ensure a process is operating at its most efficient.
  - C. A culture of continuous improvement and considered an important aspect of an organization's long-term strategy.
  - D. This covers all activities from design to documentation. It also includes the regulation of quality of raw materials, assemblies, products and components, services related to production, and management and inspection processes.

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

Marco Maran’s X3 Chair is elegant, flexible, strong and manufactured using innovative technologies, see **Figure 9**. The chair is widely used in restaurants due to its low price and its particular characteristics. The price is approximately US\$50.

The seat and back of the chair is created by bio-injection moulding. The chair is manufactured from a clear polycarbonate called Desmopan®.

Desmopan® is a thermoplastic polyurethane elastomer which has the strength of polyurethane, but the characteristics of rubber. The geometric arrangement in the structure gives the chair a distinctive look, structural strength and performance characteristics that many consumers like.

**Figure 9: The X3 Chair**



[Source: Images with permission from Maxdesign.]

36. Why would designers use digital humans in the early design stages of the X3 Chair?
- A. To reduce the need for physical prototyping
  - B. To assist the manufacturer in obtaining feedback about the comfort of the product
  - C. To evaluate performance of the product after it has been manufactured
  - D. To provide accurate data when testing the final prototype

- 37.** Which production method would be used for the X3 Chair?
- A. Batch production
  - B. One-off customization
  - C. Mass production
  - D. Mass customization
- 38.** Which manufacturing method is most suitable for the seat and back of the X3 Chair?
- A. Laminating
  - B. Moulding
  - C. Casting
  - D. Weaving
- 39.** A company charges different prices for different models of the same product.  
What is the business practice the company is applying?
- A. Competitive pricing
  - B. Product versioning
  - C. Price variation
  - D. Product generations
- 40.** Which of the following best describes break-even?
- A. The point at which the revenue from the sale of the Marco Maran X3 Chair equals the fixed costs
  - B. The point at which the revenue from the sale of the Marco Maran X3 Chair equals the total costs
  - C. The point at which the revenue from the sale of the Marco Maran X3 Chair equals the variable costs
  - D. The point at which the revenue from the sale of the Marco Maran X3 Chair equals the sale price
-

**References:**

**Figure 1** Anna Shvets / Pexels.

**Figure 2** DariuszSankowski / Pixabay.

**Figure 3** Images provided with permission from Nissin Dental Products B.V. / Nissin Inc.

**Figure 6** Maryna Iaroshenko / iStock.

**Figure 7** Images by scanrail / iStock.

**Figure 9** Images with permission from Maxdesign.

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