Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Higher level
Paper 1

8 May 2024

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

1 hour

Instructions to candidates

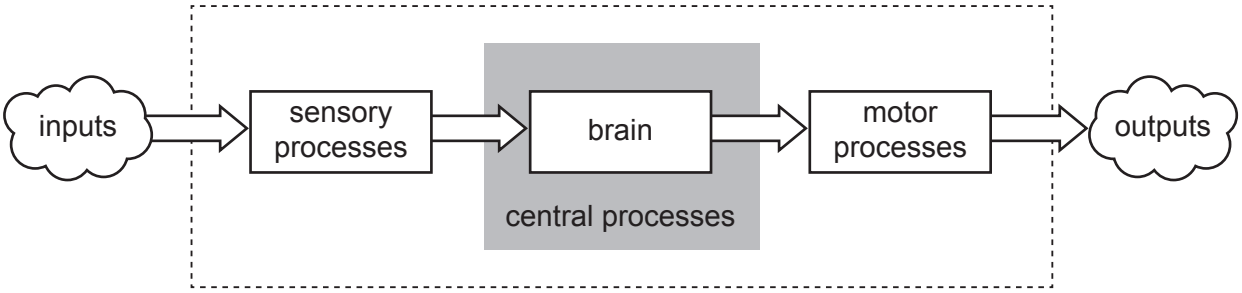
- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is **[40 marks]**.

2224 – 6405

23 pages

1. **Figure 1** shows a flow diagram representing a human information processing system.

Figure 1: Human information processing system diagram



Which part of the human information processing system is related to physiological factors?

A. Sensory processes

B. Central processes

C. Motor processes

D. Inputs

2. When considering the layout of furniture and equipment for an open-plan office, which aspect of ergonomics would be most important?

A. Adjustability

B. Range of sizes

C. Biomechanics

D. Clearance

3. What natural resources can be identified in terms of quantity and quality?

A. Renewable

B. Non-renewable

C. Reserve

D. Renewability

4. **Figure 2** shows LG's newest front-loading washing machine that uses 25 litres less water than previous models.

Figure 2: LG's newest front-loading washing machine

[Source: Image with permission from LG Electronics.]

Series 5

Which process requires the least energy?

A. Recycling

B. Repairing

C. Reconditioning

D. Re-engineering

5. **Figure 3** shows a hiker using portable solar panels to charge and power their devices.

Figure 3: Solar charger for remote hikers

The solar charger allows for small amounts of energy to run low-energy products using what type of energy system?

A. National grid

B. Combined heat and power

C. Individual energy generation

D. Embodied

6. Which of the following encourage manufacturers to consider embracing green design and clean technology?

I. Consumer Pressure

II. Legislation

III. Increased energy costs

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

7. **Figure 4** shows *Pritt Stick* adhesive used for gluing paper and card. It was originally invented in 1969; more recently the company has improved the formulation so it is now made from 97 % natural ingredients.

Figure 4: *Pritt Stick* adhesive

What is this change to the increased use of natural materials an example of?

A. Clean technology

B. Life cycle analysis (LCA)

C. Reconditioning

D. Green design

8. Which of the technologies listed can be referred to as a converging technology?

I. Nanotechnology

II. Haptic technology

III. Biotechnology

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

9. What type of drawing are part and assembly diagrams most likely to be presented in?

A. Isometric

B. Elevation

C. Perspective

D. Exploded

10. The Stanford Solar Car Project (SSCP) is a team of students who design, build, and test a solar-powered electric vehicle. **Figure 5** shows a student testing the inside of the driver's cockpit.

Figure 5: Testing the Stanford Solar Car cockpit

[Source: Jim Merithew, Wired, © Condé Nast.]

Which of the following best describes the type of model shown in **Figure 5**?

A. Mock-up

B. Aesthetic

C. Finite element analysis (FEA)

D. Scale

11. Danish designer Matthias Bengtsson designed the Slice chair in 1998, see **Figure 6**. The data from the computer-aided design (CAD) program was exported to a laser-cutter to cut the hundreds of 3 mm-thick plywood slices which were then assembled by gluing each slice to form the layers of the chair.

Figure 6: The Slice chair

[Source: © Cooper Hewitt, Smithsonian Design Museum / Art Resource, NY.]

What example of rapid prototyping method has been used to produce the Slice chair?

A. Stereolithography (SLA)

B. Fused deposition modelling (FDM)

C. Laminated object manufacture (LOM)

D. Selective laser sintering (SLS)

12. **Figure 7** shows the UFO Sinker, a lead-free fishing weight made of a unique high density concrete composite as an environmentally friendly alternative for traditional sinkers made of lead.

Figure 7: UFO Sinker lead-free fishing weights

What property of the material is essential for the UFO Sinker to work effectively?

A. Mass

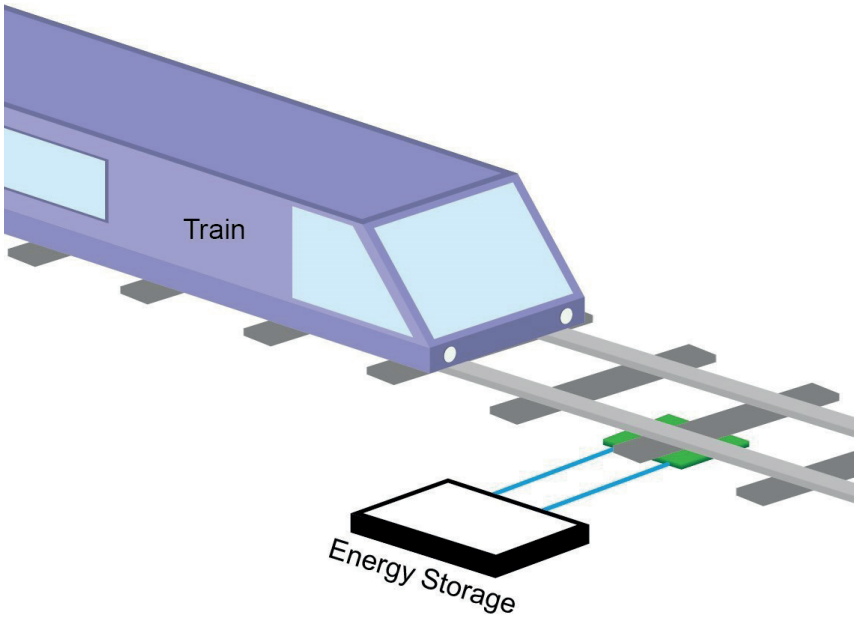
B. Hardness

C. Weight

D. Toughness

13. **Figure 8** shows an example of a smart technology developed by international company Innitrax. This smart material generates energy from pressure and stress on the railway track of passing trains to generate electricity.

Figure 8: Smart material used to generate electricity



Which property applies to this smart material?

A. Thermoelectric

B. Piezoelectric

C. Shape memory alloy

D. Electro-rheostatic

14. Modifying the physical properties of a material by decreasing the hardness and brittleness but increasing the ductility is known as:

A. Alloying

B. Tempering

C. Work hardening

D. Grain size

15. Plywood is created by gluing layers of wood (plys) together. Why are the layers glued together with the grain of each layer in an opposite direction?

A. Increase aesthetics

B. Increase hardness

C. Increase density

D. Increase strength

16. Which production method best describes the scale used to manufacture, produce or process materials without interruption?

A. One-off

B. Batch

C. Continuous

D. Mass customization

17. Which of the following is a joining technique?

A. Casting

B. Fusing

C. Thermoforming

D. Laminating

18. Which process is used to convert yarn into fabric by matting the fibres together?

A. Turning

B. Spinning

C. Felting

D. Weaving

19. Robotic manufacturing systems that have their own central control unit containing machine vision sub-systems acting as their “eyes” are known as:

A. Mechanized robots

B. Multi-task robots

C. Machine to machine (M2M) robots

D. Wired robots

20. **Figure 9** shows the *chapeau claque* collapsible top hat which folds flat for easy storage. *Chapeau* is the French word for “hat” and the word *claque* refers to the sound the hat makes as it opens with the help of a spring.

Figure 9: *Chapeau claque* collapsible top hat

Which strategy was used to decide the name for the hat?

A. Analogy

B. Adaptation

C. Chance

D. Insight

21. **Figure 10** shows a BIC ballpoint pen first manufactured in the 1950s when it was seen as a radical new product. It has undergone only minor design changes since and still sells well.

Figure 10: BIC ballpoint pen

What is the most likely reason for the continued success of the pen?

A. Very little competition in the marketplace

B. Ballpoint pens will never become obsolete

C. It is still viewed as a pioneering design

D. It has a good balance of form and function

22. Which statement is true for user-centred design (UCD)?

A. Iterative

B. Linear

C. Cyclic

D. Oscillating

23. **Figure 11** shows the Philips electronic fresh air mask which is designed to appeal to style conscious young consumers.

Figure 11: Philips electronic fresh air mask

Which characteristic of the user-product interface was most important to the designer of the mask?

A. Low memory burden

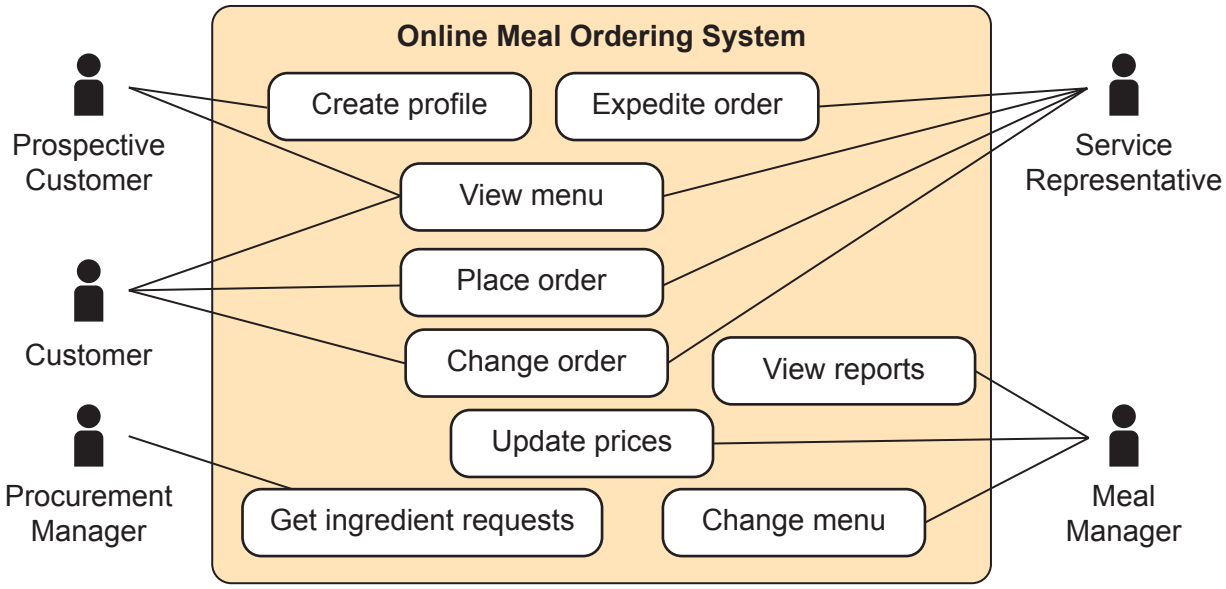
B. Affordance

C. Visibility

D. Intuitive logic

24. **Figure 12** shows the possible sequences of interactions between all users in the project planning of a new online meal ordering system.

Figure 12: Planning of a new online meal ordering system



Which strategy for user research has been used in **Figure 12**?

A. Scenario

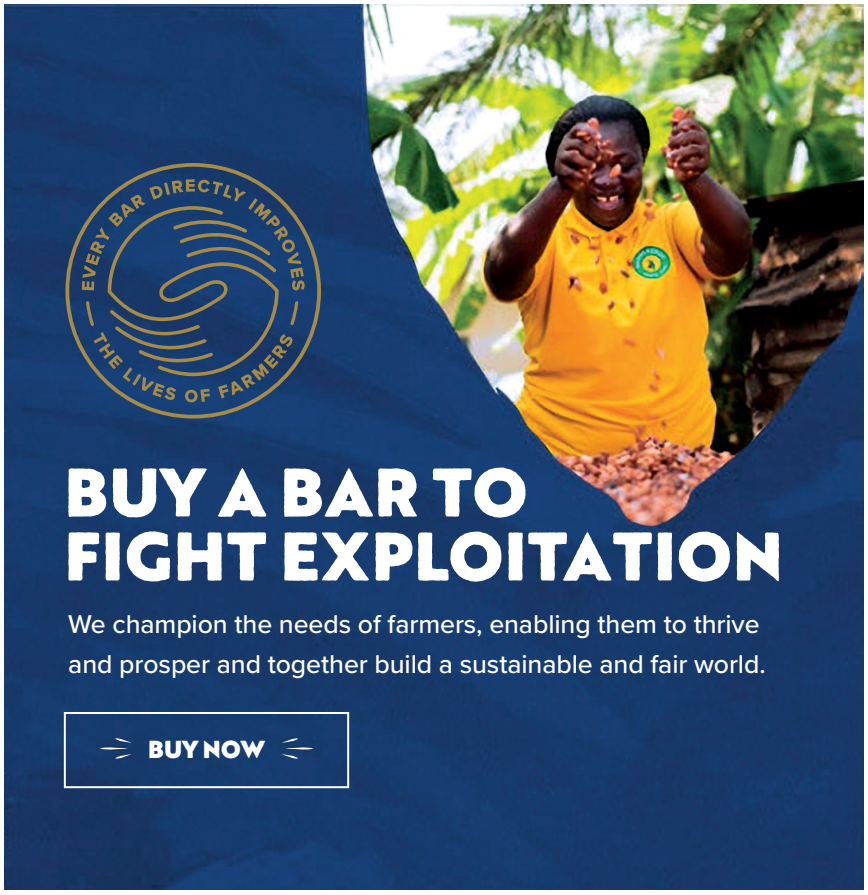
B. Use case

C. Personae

D. Classification of users

25. **Figure 13** shows an image of the Divine website. Divine is the only chocolate company in the world which is 100 % Fairtrade and owned by cocoa farmers.

Figure 13: Divine website



Which emotional pleasure has Divine prioritized on its website?

A. Physio-pleasure

B. Psycho-pleasure

C. Socio-pleasure

D. Ideo-pleasure

26. Which factors contribute to a triple bottom line sustainability policy?

I. Social

II. Economic

III. Ergonomic

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

27. Which of the following describes someone who is influential in ensuring a company adopts environmentally friendly policies?

A. Eco-warrior

B. Eco-champion

C. Eco-follower

D. Eco-fan

28. **Figure 14** shows trash bags which are made from plant starch and are completely compostable and biodegradable.

Figure 14: Compostable trash bag

Which of Datschefski's five principles of sustainable design do the compostable trash bags, shown in **Figure 14**, best fulfil?

A. Safe

B. Solar

C. Cyclic

D. Social

29. Which sustainable innovation strategy facilitates the diffusion of sustainable products and solutions into the marketplace by raising awareness to government policy holders?

A. Energy security

B. Macro energy sustainability

C. Micro energy sustainability

D. Take-back legislation

30. A clothing company that provides products for people outside the normal percentile range is selling to which type of market?

A. Market sector

B. Market segment

C. Market mix

D. Mass market

31. Which strategies contribute to market research?

I. Expert appraisal

II. Environmental scanning

III. Perceptual mapping

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

32. **Figure 15** shows Apple's logo and slogan from 1997–2002.

Figure 15: Apple "Think Different." logo

Which of the following does **Figure 15** represent?

A. Advertising

B. Quality mark

C. Branding

D. Safety

33. Which of the following is a feature of lean production?

A. Reduced energy costs

B. Reduced training costs

C. Reduced overheads

D. Reduced materials and components

34. Which of the following are true of computer integrated manufacture (CIM)?

I. Large labour force

II. Large capital costs

III. Large economies of scale

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

35. Which of the following is classed as a variable cost?

A. Machinery

B. Labour

C. Overheads

D. Advertising

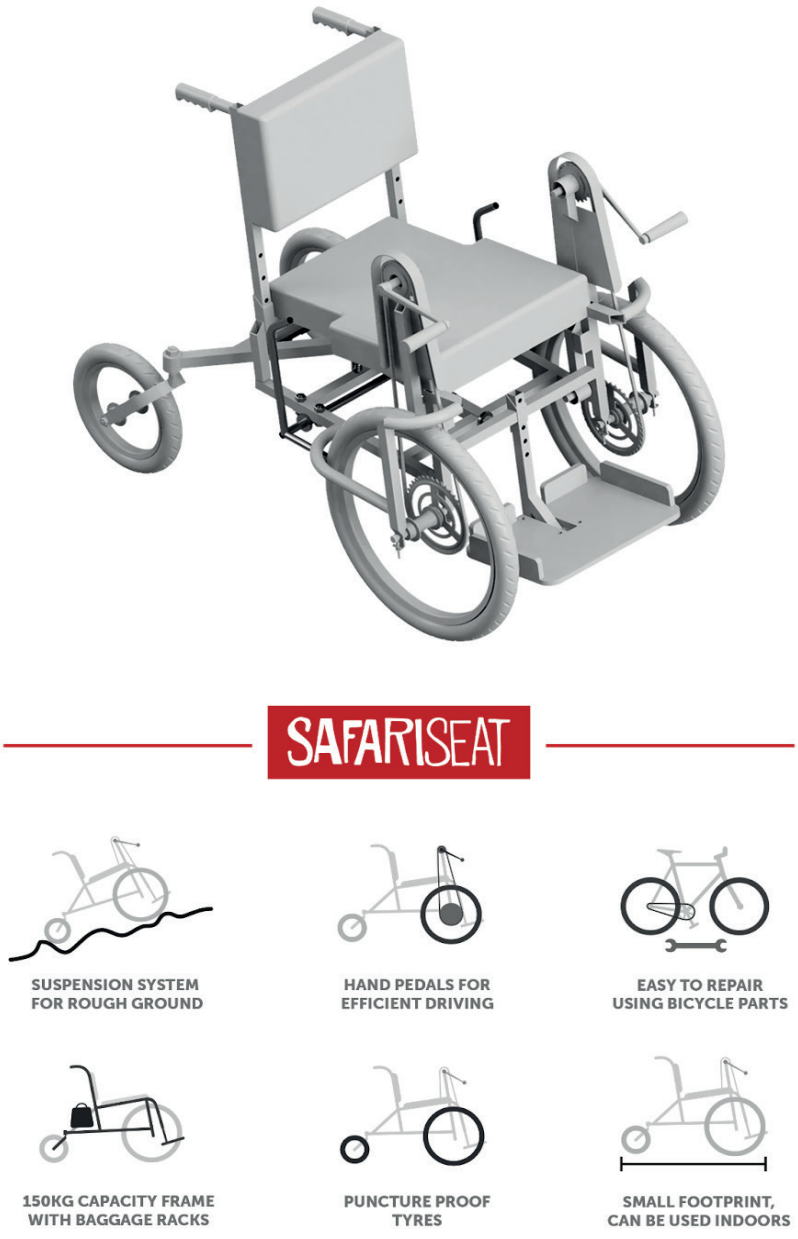
Questions 36 – 40 relate to the following case study. Please read the case study carefully and answer the questions.

The SafariSeat is an all-terrain wheelchair design that can be manufactured using standard bicycle parts that are easily locally sourced in low-resource regions of the world, see **Figure 16**.

Figure 16: The SafariSeat first prototype (with lever propulsion)

Designer and co-founder, Janna Deeble grew up in Kenya and recognized the need for affordable, repairable wheelchairs. The design team employed a user-centred design (UCD) process and local, community-based manufacturers to make prototypes during the SafariSeat's development process, see **Figure 17**. Creating employment in the local community is also one of SafariSeat's aims.

Figure 17: The SafariSeat design features



Using standard bicycle parts, the SafariSeat adapts hand pedals and sprockets for efficient driving, suspension for stability on uneven terrain, and the wheel and frame configuration can be customized dependent on the users' needs and the bicycle parts available, see **Figure 18**.

Figure 18: The SafariSeat in action

Over 90 % of people living in low-resource regions of the world who need a wheelchair cannot access one, and the SafariSeat aims to fill this gap.

36. To design the SafariSeat, which of the following would have been considered?

I. Anthropometric data
II. Psychological factor data
III. Physiological factor data

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

37. Which waste mitigation strategy is the SafariSeat utilizing?

A. Dematerialization

B. Recycle

C. Recondition

D. Re-engineering

38. Which production system is the SafariSeat employing?

A. Batch production

B. Mass customization

C. Design for assembly

D. Assembly line production

39. Which of the following was Deeble's driver for inventing the SafariSeat?

A. Constructive discontent

B. Desire to make money

C. Desire to help others

D. The need to express creativity

40. Which of the following user-centred design (UCD) process would SafariSeat have used?

I. Surveys
II. Observation
III. Participatory design

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

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References:

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Figure 5 Jim Merithew, Wired, © Condé Nast.

Figure 6 © Cooper Hewitt, Smithsonian Design Museum / Art Resource, NY.

Figure 7 UFO Sinker, n.d. *UFO Sinker* [image online] Available at: http://ufosinker.com/img/produkty/hruska.png [Accessed 22 February 2023].

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