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Design technology
Standard level
Paper 1

16 May 2025

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]**.

1. **Figure 1** shows computer workstations that allow doctors to move easily from room to room when consulting with patients.

Figure 1: Computer workstations in a hospital



[Source: With permission from Altus, Inc.]

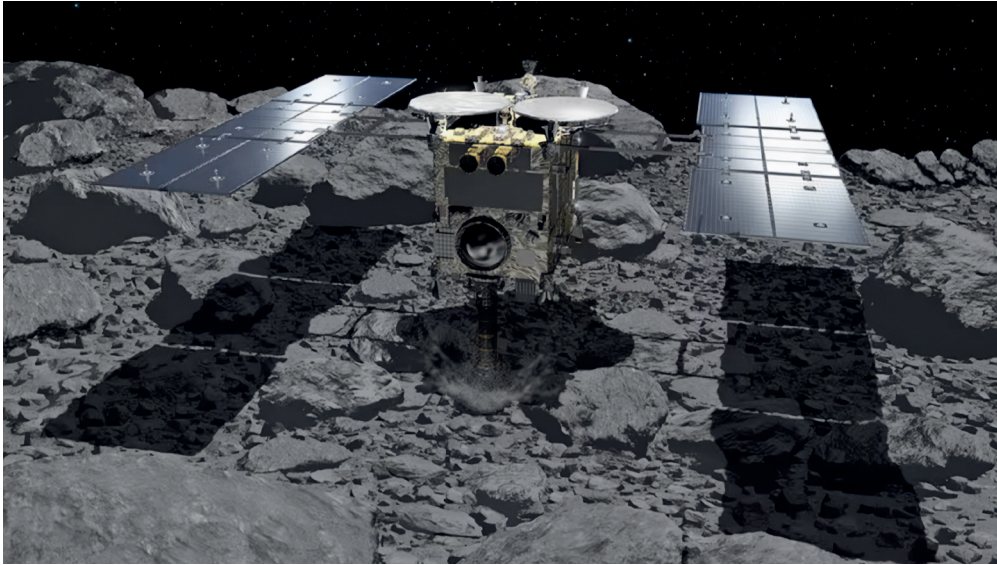
To protect doctors from developing repetitive strain injury which ergonomic design feature is essential?

- A. Fixed monitor height
 - B. Non-adjustable chair
 - C. Fixed keyboard tilt
 - D. Height-adjustable desk
-
2. Which of the following factors is considered in ergonomic keyboard design based on anthropometric data?
 - A. Keyboard length
 - B. Wrist angle and forearm length
 - C. Monitor resolution and refresh rate
 - D. Mouse sensitivity and tracking speed

3. Using a structured interview to gather user feedback is an example of:
- A. Qualitative data collection
 - B. Quantitative data collection
 - C. Experimental research
 - D. Secondary research
4. Which design characteristic can positively impact the user's perception of a space or product?
- A. High noise levels
 - B. Poor lighting
 - C. Clean and organized layout
 - D. Limited user control

5. Water has been found in an asteroid sample collected by Japan's Hayabusa2 space probe, marking the first discovery of its kind. **Figure 2** shows an artist's rendering of the Hayabusa2 space probe hovering over an asteroid.

Figure 2: An artist's rendering of the Hayabusa2 space probe



Water found on an asteroid can be used for fuel and life support.

Which of the following terms best describe an asteroid with a confirmed presence of water in the context of a future mining mission?

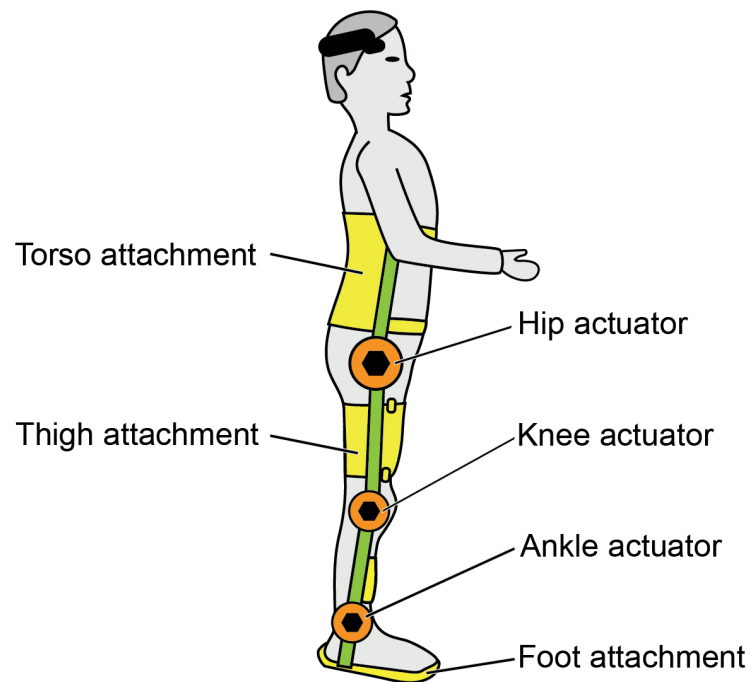
- A. Resource
 - B. Reserve
 - C. Prospect
 - D. Unexplored
6. To minimize the environmental impact of water extraction from asteroids for future mining missions, which of the following waste mitigation strategies should be employed?
- A. Recycling
 - B. Landfill disposal
 - C. Emission control
 - D. Disposal in space

7. Which of the following energy sources would be the most sustainable and efficient option for powering mining operations on asteroids?
- I. Solar
 - II. Battery
 - III. Nuclear
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
8. What is the primary advantage of using combined heat and power (CHP) systems for electricity generation compared to conventional power plants?
- A. Higher efficiency
 - B. Lower initial installation costs
 - C. Reduced greenhouse gas emissions
 - D. Longer operational lifespan
9. Which mitigation strategy prevents carbon emissions being released into the atmosphere?
- A. Carbon offsetting through renewable energy projects
 - B. Implementing energy efficiency measures in industries
 - C. Utilizing carbon capture and storage (CCS) technology
 - D. Promoting the use of electric vehicles

- 10.** What are the primary drivers that motivate manufacturers to implement environmentally friendly practices and clean up their manufacturing processes?
- I. Increased government regulations and environmental policies
 - II. Reduced operational costs and resource efficiency
 - III. Short-term financial gains and profit maximization
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
- 11.** What is the key principle of the “cradle to cradle” design approach that distinguishes it from the traditional linear “cradle to grave” design model?
- A. Minimizing waste and resource consumption during the product’s life cycle
 - B. Designing products with a focus on their end-of-life disposal and recycling
 - C. Ensuring that products can be reused, repaired, or recycled indefinitely
 - D. Using environmentally friendly materials and manufacturing processes

12. **Figure 3** shows the conceptual model of a wearable exoskeleton for the physical treatment of children with motor impairment.

Figure 3: Conceptual model of a wearable exoskeleton



What is the primary role of conceptual modelling in the design process of a wearable exoskeleton (see **Figure 3**)?

- A. To create physical prototypes of the product
 - B. To conduct rigorous testing and analysis of the design
 - C. To visualize and communicate design ideas
 - D. To finalize the detailed design specifications
13. What is the primary function of aesthetic models in the product development process?
- A. To create aesthetically pleasing prototypes
 - B. To look and feel like the final product
 - C. To serve as functional prototypes
 - D. To conduct market research

14. In product design and development, finite element analysis (FEA) systems can assist with:

- I. Stress and deformation analysis of components
- II. Conducting ergonomic assessments and user testing
- III. Simulating fluid flow and heat transfer within the product

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

15. What are the advantages of using rapid prototyping techniques in product development:

- I. Allows for testing multiple design iterations quickly
- II. Facilitates collaboration among design teams
- III. Enables customization and personalization of products for customers

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

16. The Kevlar car tyre in **Figure 4** can last for years and roll for thousands of miles without getting punctured.

Figure 4: Section of a Kevlar tyre



Which mechanical properties of Kevlar primarily enhance the durability and puncture resistance of tyres?

- A. Ductility
 - B. Hardness
 - C. Tensile strength
 - D. Stiffness
17. In which design context is thermal conductivity of materials particularly important?
- A. Designing high-performance computer processors
 - B. Creating modern art installations
 - C. Developing fashion clothing lines
 - D. Designing eco-friendly packaging

- 18.** In which context is the aesthetic characteristic of texture particularly significant in fashion design?
- A. Designing an outdoor billboard advertisement
 - B. Creating a user interface (UI) for a mobile app
 - C. Developing a high-performance sportswear collection
 - D. When coordinating accessories with an outfit
- 19.** Which is the best use of shape memory alloy properties within the medical design industry?
- A. Designing medical instruments
 - B. Creating eco-friendly packaging for medical products
 - C. Developing stents for treating narrowed or blocked blood vessels
 - D. Producing syringes for drug administration
- 20.** Which components manufactured from superalloys benefit from the high-temperature strength and resistance to creep?
- I. Jet engine turbine blades
 - II. High-performance racing cars
 - III. Nuclear power plant components
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

- 21.** Which properties of composites make them highly desirable in vehicle design?
- I. High electrical conductivity and thermal resistance
 - II. Low density and high strength-to-weight ratio
 - III. High stiffness and corrosion resistance
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
- 22.** What is the primary method used to manufacture polyethylene terephthalate (PET) bottles?
- A. Compression moulding
 - B. Injection moulding
 - C. Thermoforming
 - D. Blow moulding
- 23.** Which of the following negative impacts on the environment are associated with mass production systems?
- I. Increased resource consumption and depletion
 - II. Increased air and water pollution due to industrial activities
 - III. Increased soil erosion due to intensive farming
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

24. The ForeverPen is designed to be a long-lasting writing utensil, see **Figure 5**. Its nib (tip) is made from a silver composite that can write smoothly like a pencil but doesn't require any lead or ink. This technology is inspired by a historical drawing technique called silverpoint.

Figure 5: The ForeverPen on a notebook



Which intellectual property (IP) protection offers exclusive rights to the unique features and functionalities of the ForeverPen, preventing others from making, using, or selling a similar invention?

- A. Copyright ©
- B. Patent
- C. Trademark TM
- D. None of the above

- 25.** How does sustaining innovation contribute to the long-term success of a company?
- A. By creating entirely new markets and transforming industries
 - B. By making minor adjustments to current business practices
 - C. By periodically introducing disruptive products to replace existing ones
 - D. By maintaining product relevance and meeting evolving customer needs
- 26.** What is the difference between “technology push” and “market pull” as drivers of innovation?
- A. Technology push focuses on consumer demand, while market pull focuses on technological advancements.
 - B. Technology push relies on market research, while market pull relies on inventors’ creativity.
 - C. Technology push and market pull are essentially the same and can be used interchangeably.
 - D. Technology push originates from new inventions, while market pull originates from consumer needs.

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

In 2023 Levi Strauss & Co celebrated the 150-year anniversary of their most iconic product the 501® Original jean, see **Figure 6**. Manufactured using denim fabric, the garment has stood the test of time to become a classic design owing to its durability, practicality and use of the cotton fibre.

Levi's® continue to be innovative and in 2022 they launched a new version of the 501® Original jean. Made with organic cotton, post-consumer recycled denim is designed to be recyclable but still offers the same comfortable textile properties.

Originally designed as work clothes for gold miners' Levi's® jeans have been worn through the ages and across cultures.

Figure 6: Iconic Levi's® 501® Original jean classic design



27. Levi's® designers must consider various cultures and communities to predict how, why and at what rate new ideas and technology will be adopted.

Which of the following product innovations best exemplifies Rogers' characteristic of "relative advantage"?

- A. Levi's® jeans with mechanical woven fabric stretch for enhanced fit, reinforced fabric panels, and improved colourfastness compared to previous models.
 - B. Levi's® skirt created in the style of a traditional jean.
 - C. Standard Levi's® jean with stonewashed style bleached denim colour to enhance their visual appearance.
 - D. Cargo style Levi's® jean with additional pockets, military style embroidered insignia patches and components for zip-on and off leg bottoms that transform into shorts.
28. What makes the Levi's® 501® Original jean a classic design that has stood the test of time?
- A. The use of organic cotton in the manufacturing process
 - B. The incorporation of features for better fit and comfort
 - C. The iconic straight leg and button-fly design that remains unchanged over the years
 - D. The introduction of trendy and fashionable washes
29. How does the balance between form and function benefit the popularity of Levi's® jeans (Figure 6)?
- A. The jeans focus solely on aesthetics, leading to a decline in their practicality.
 - B. The jeans are fashionable yet durable and comfortable to wear.
 - C. The jeans prioritize utility, making them unappealing to fashion-conscious consumers.
 - D. The focus on aesthetics makes the jeans suitable for occasional wear but not for everyday use.

30. What does it mean for the Levi's® 501® Original jean to be considered a dominant design?
- A. It refers to Levi's® being the only denim brand available in the market
 - B. It means the Levi's® 501® Original jean has consistently outsold all other denim brands
 - C. It indicates the Levi's® 501® Original jean has features recognized as essential in the denim industry
 - D. It suggests the Levi's® 501® Original jean is a luxury product exclusively branded towards high-end consumers
-

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References:

- Figure 1:** Altus, 2024. *2024 Trends in Height Adjustable Workstations for the Healthcare Industry*. [image online] Available at: <https://www.altus-inc.com/insight?categories=workstations> [Accessed 5 November 2024].
- Figure 2:** Illustration by Akihiro Ikeshita.
- Figure 4:** With permission from ZC Rubber Group.
- Figure 5:** ForeverPen. With permission from World's Tiniest. www.worldstiniest.com.