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Design technology

Higher level

Paper 1

15 May 2026

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

1 hour

Instructions to students

- 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. Passengers use overhead handles to steady themselves on moving trains.

Figure 1: Train traveller using an overhead handle



What percentile is used to determine the grip height of handles used in public transport, **see Figure 1**?

- A. 5th
 - B. 50th
 - C. 95th
 - D. 5th–95th
-
2. Which research method is most suitable for collecting psychological factor data to be used in airport lounge design?
 - A. Expert appraisal
 - B. User trial
 - C. Literature search
 - D. Performance testing

3. Much of India's rural population relies on smallholder farming where about 30 % of agricultural produce is being wasted. An initiative from Science for Society helps farmers by providing them with solar-powered food drying systems, such as the one shown in **Figure 2**, to convert food waste from farming into ingredients for the food industry.

Figure 2: Solar-powered food dehydrator



Which green design objectives are addressed by this initiative?

- A. Materials and Energy
 - B. Waste and Energy
 - C. Pollution and Materials
 - D. Waste and Materials
4. Which renewable energy resource harnesses energy from the sun?
- A. Nuclear energy
 - B. Biomass energy
 - C. Tidal energy
 - D. Geothermal energy

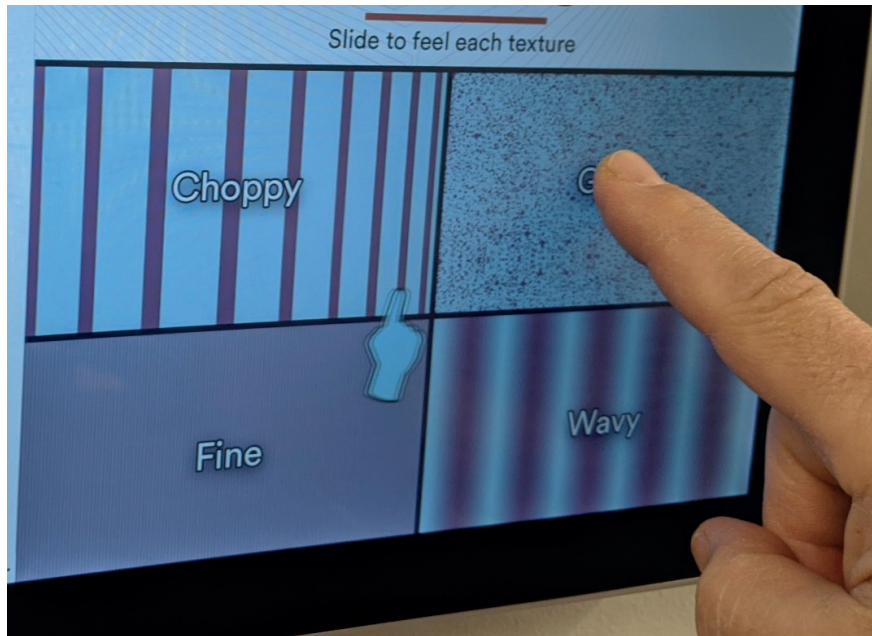
5. Which of the following is a renewable material?
- A. Plastic
 - B. Glass
 - C. Timber
 - D. Metal
6. A catalytic converter is a device that converts toxic gases from a combustion engine into less toxic pollutants.

Which statement best describes a catalytic converter in terms of clean technology?

- A. It is a radical solution.
 - B. It is a systems level solution.
 - C. It is an end-of-pipe technology.
 - D. It eliminates all waste materials.
7. Which statement best describes a circular economy?
- A. It is a design philosophy that uses as little material as possible.
 - B. It is a design philosophy that traps carbon into products.
 - C. It follows a cradle-to-grave philosophy.
 - D. It follows a cradle-to-cradle philosophy.

8. Tanvas technology creates the sensation of different surface textures on a flat touchscreen as a user slides a finger across a digital illustration (see **Figure 3**). Developed in the Neuroscience and Robotics Laboratory at Northwestern University, it allows users to engage their sense of touch.

Figure 3: Tanvas flat touchscreen



Which technology enables interaction with digital content through touch?

- A. Virtual modelling
- B. Finite element analysis (FEA)
- C. Motion capture
- D. Haptic technology

9. Products that include components that are placed under stress or strain are often modelled in a computer-aided design (CAD) programme. The CAD programme can run virtual tests on products called “finite element analysis” (FEA).

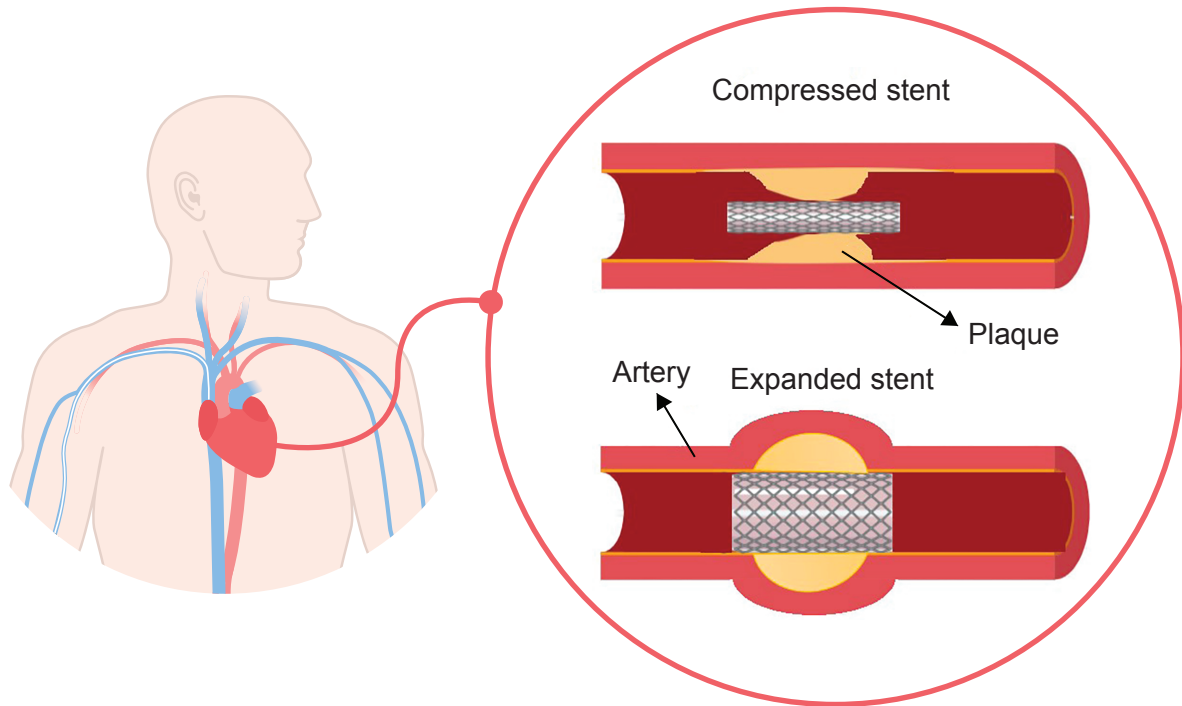
What is the main purpose of finite element analysis (FEA)?

- A. To create an animation of a product that shows it in use
 - B. To test a range of colours and textures on a product
 - C. To create a realistic model of a product to gather feedback from a client
 - D. To predict and understand how an object may behave under various physical conditions
10. What is a disadvantage of using a scale model to communicate with a client?
- A. It can be difficult to identify individual components of a prototype
 - B. It can be difficult to compare the relative size of components to each other
 - C. It can be difficult to test in the environment where it will be used
 - D. It can be difficult to discuss the colour of the prototype

11. An arterial stent is a wire mesh tube that holds an artery open to restore normal blood flow where plaque has built up.

The material properties of the stent in **Figure 4** allows it to be compressed and placed into the artery, where it will expand to its full diameter returning to its original shape.

Figure 4: Compressed and expanded views of an arterial stent



Which material is used to manufacture stents due to its ability to self-expand after implantation?

- A. Super alloy
 - B. Shape memory alloy
 - C. Piezoelectric
 - D. Magneto-rheostatic
12. Which material property makes glass a popular choice in the design of modern office buildings?
- A. High thermal conductivity
 - B. High tensile strength
 - C. Low density
 - D. Transparency

13. Which of the following methods are used to modify the mechanical properties of metals?

- I. Work hardening
- II. Tempering
- III. Alloying

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

14. Which of the following is a physical property of a material?

- A. Hardness
- B. Stiffness
- C. Toughness
- D. Elasticity

15. What is true for assembly line production?

- I. It is a volume production process
- II. It is suitable for mass customization
- III. The assembly line rarely stops

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

16. Swoppit is a startup connecting Gen Z*'s consumption needs with climate action through a clothes-swapping marketplace.

The clothing exchange app, see **Figure 5**, offers an eco-friendly and enjoyable fashion experience for those who love fashion but also care about the environment.

Self-expression through fashion becomes possible without a guilty conscience with this alternative to traditional shopping.

Figure 5: An outline of how to use Swoppit



Which role would best describe the founder of Swoppit?

- A. Innovator
- B. Entrepreneur
- C. Product champion
- D. Inventor

* Gen Z (Generation Z): Those born between the mid-1990s and early 2010s, characterized by their comfort with technology and concern for social issues.

- 17.** Which of the following is an example of sustaining innovation?
- A. The consistent improvements in a laptop battery life
 - B. The first instance of an assembly line in the automobile industry
 - C. The introduction of a new communication device such as the mobile (cell) phone
 - D. The combination of two devices into one product
- 18.** How would early adopters be described as a group of consumers?
- A. The first individuals to adopt an innovation
 - B. The second fastest category to adopt an innovation
 - C. The third fastest group to adopt an innovation
 - D. The last group to adopt an innovation

19. The centuries-old Hinoki wooden bathtub, see **Figure 6**, is an example of traditional Japanese craftsmanship reflecting the harmony between nature and daily life as a Japanese design philosophy.

A standard size Hinoki wooden bathtub can cost as much as USD 8230 and can be found in residential homes, traditional Japanese hotel rooms or inn's known as Ryokan.

Figure 6: Hinoki wooden bathtub



What distinguishes the Hinoki wooden bathtub as a classic design?

- A. Material
 - B. Manufacturing process
 - C. Omnipresence
 - D. Retail cost
20. Which of the following is a fundamental principle of classic design?
- A. Ornate decoration over utility
 - B. Form follows function
 - C. Innovation above tradition
 - D. Aesthetic appeal over innovation

- 21.** What best describes a dominant design?
- A. The design has been mass produced over a long period of time
 - B. The design is considered classic in multiple cultures across the world
 - C. The design was once considered desirable but has fallen out of fashion
 - D. The design includes implicit features that are recognised as essential by most consumers

- 22.** A usability laboratory is designed for users to complete tasks while designers watch, listen and take notes on how they interact with a product, this is often recorded.

What is the main advantage of using a usability laboratory to observe users prior to finalizing the design of a product?

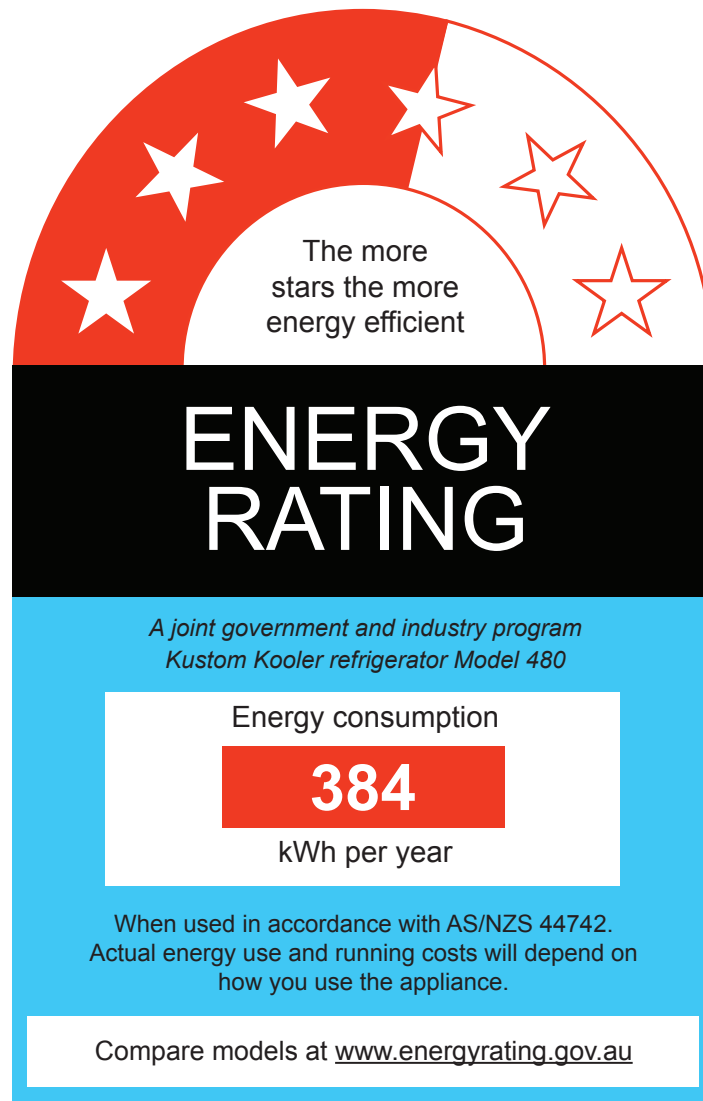
- A. Designers can analyse the recordings and their notes at a later time
- B. Users can provide verbal feedback and opinions directly to the designers
- C. Users are able to interact with the products without any guidance
- D. Products are always instrumented recording all of the users interactions

- 23.** Which stage of user-centred design (UCD) would most likely utilize a personae?
- A. Research
 - B. Concept
 - C. Design
 - D. Implementation
- 24.** Why would a designer develop an anti-persona during user-centred research?
- A. To ensure their wants and needs are met by the product
 - B. They may be targeted to buy the product for another user
 - C. To ensure they can use the product efficiently
 - D. To help establish what the product does and does not offer to the user

25. The Australian government uses an Energy Rating Label scheme for consumer electronics with a star system to visually indicate the relative energy performance of a device, see **Figure 7**.

An indication of the energy consumption for typical use per year is also included.

Figure 7: Australian energy rating label



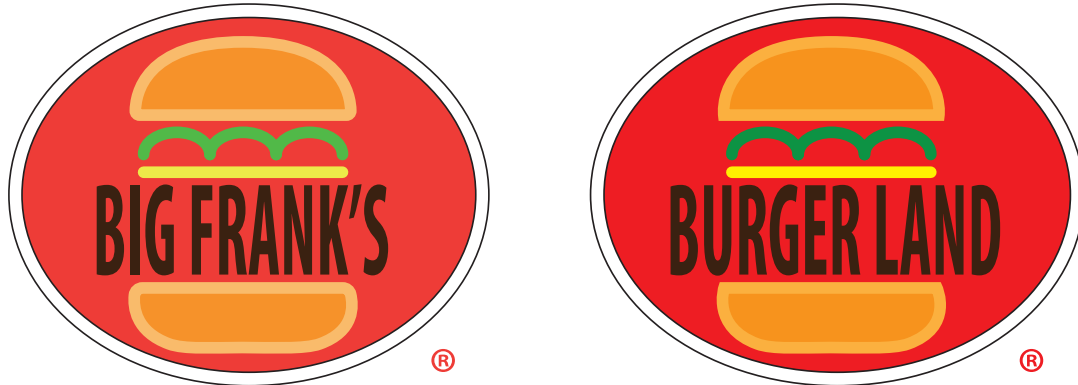
Why do some governments legislate the use of energy labelling schemes?

- A. To tell consumers how much the machine will cost them to run per year
- B. To encourage consumers to purchase more efficient products
- C. To indicate how much energy was used in the manufacture of the product
- D. To encourage consumers to buy the most expensive products

- 26.** For what purpose would a government have an energy generation policy that combined the use of fossil fuels with renewable sources?
- A. Energy efficiency
 - B. Energy sustainability
 - C. Energy security
 - D. Energy storage
- 27.** Sustainability reporting focuses on which four aspects of a company's performance?
- A. Employee well-being, Environmental, Social and Governance
 - B. Economic, Environmental, Social and Governance
 - C. Economic, Environmental, Investment and Transparency
 - D. Economic, Environmental, Innovation and Governance

28. For legal reasons the American fast food chain Burger Land could not operate under its own brand name in the United Kingdom. Therefore, the brand, “Big Frank’s” was created, and they have been trading under this name since 1983.

Figure 8: Big Frank’s logo (left), Burger Land logo (right)



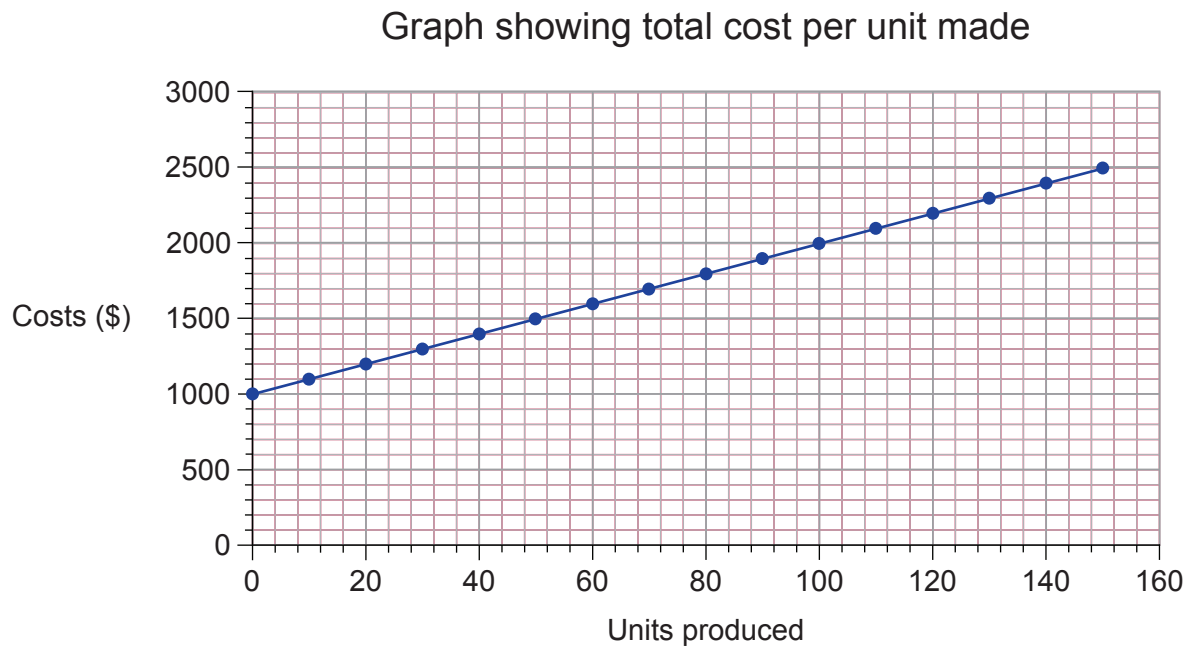
Why is it important for the logo of the United Kingdom fast food chain Big Frank’s to mirror the original logo of the American Burger Land brand?

- A. Consumers visiting from abroad will recognise the brand and know what to expect
 - B. The company can use packaging that is exactly the same
 - C. The name “Burger Land” can be trademarked in the United Kingdom after a period of time
 - D. The products can be marketed to a completely different market segment
29. Why would a company consider an imitative strategy?
- A. It requires investment in market research
 - B. It is a low-risk strategy
 - C. It is a high-risk strategy, but has high potential for reward
 - D. It focuses on launching products that are different to those already available

- 30.** Why would a company only sell products via an Internet store?
- A. No need to rent a physical storage space to store products
 - B. No need to rent a physical retail space for displaying products
 - C. No need to hire employees
 - D. No need to have a returns policy for unsuitable products
- 31.** Which market research strategy involves reviewing newspapers and magazines to discover information about a targeted market?
- A. Environmental scanning
 - B. User research
 - C. Perceptual mapping
 - D. Literature search

32. When calculating economic viability for a product, the manufacturer must consider fixed and variable costs, see **Figure 9**.

Figure 9: Graph showing total cost per unit made of a product



What is the value of fixed costs for this product?

- A. \$10
 - B. \$100
 - C. \$1000
 - D. \$10 000
33. What is a characteristic of lean production?
- A. Just-in-case (JIC) supplies
 - B. Quality control (QC) and continuous improvement
 - C. Recycling all defective products
 - D. Task-focused workforce

- 34.** Which is true for computer-integrated manufacturing (CIM) for the manufacturer?
- A. No training required to train the workforce
 - B. Easy maintenance of the machinery
 - C. Low investment required
 - D. Fewer errors made in products
- 35.** Which aspect makes a just-in-time (JIT) strategy risky?
- A. Ensuring a steady supply of raw materials
 - B. Running out of storage for raw materials
 - C. Running out of storage for products
 - D. Increased waste due to overproduction

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

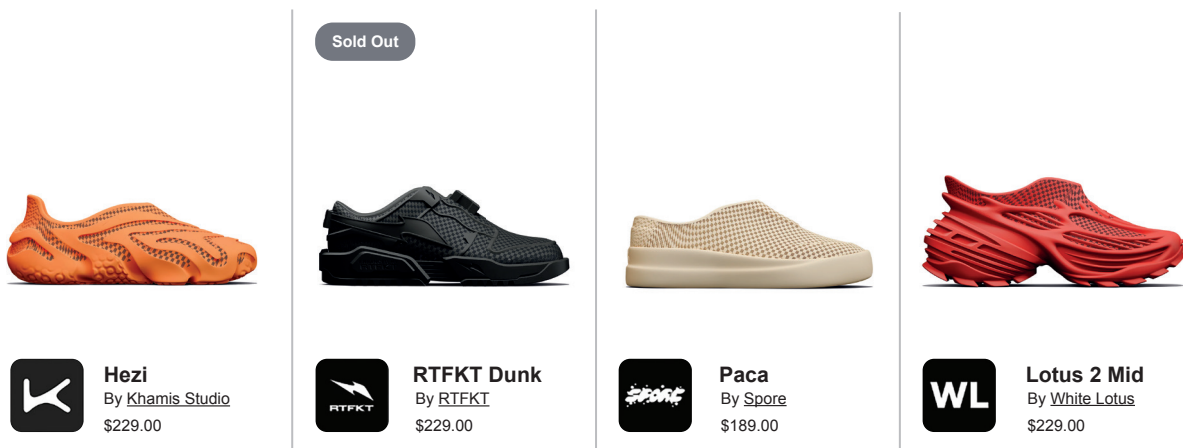
Cornelius Schmitt, CEO of Zellerfeld, has a goal to put fully recyclable 3D-printed shoes “on every foot in the world”.

The Zellerfeld shoe, see **Figure 10**, is made to order. Since startup Zellerfeld have designed and developed their own range of MONO1 through to GEN3 3D printers to create custom-designed shoes. Customers scan their feet with a smartphone which is used as a base for their shoe design and can even launch their own brands through Zellerfeld’s website.

Computer-aided design (CAD) software is used to adapt the shoe to fit the exact shape of the user’s feet. Recent collaborations with brands such as Louis Vuitton highlight how Zellerfeld’s technology is being applied across fashion and luxury markets.

The Zellerfeld shoes are made out of a single material, thermoplastic polyurethane (TPU), and can be returned to the company at disposal for them to make new shoes out of the old ones.

Figure 10: Zellerfeld 3D printed shoes



36. Why does Zellerfeld design the shoes to fit the user’s feet exactly?
- A. To ensure maximum comfort for the user when using the shoes
 - B. To create a unique product for the user that no one else can use
 - C. To create a fully recyclable product
 - D. To create a highly fashionable product users will pay more for

- 37.** Zellerfeld meets the requirements of take-back legislation, which means they take back the shoes at the end of their life.

Which of the following waste mitigation strategies applies to the Zellerfeld shoes?

- A. Recondition
 - B. Re-engineer
 - C. Repair
 - D. Recycle
- 38.** Which of the following properties makes thermoplastic polyurethane (TPU) ideal for a 3D printing process?
- A. High toughness
 - B. Softens when heated above 250 °C
 - C. High durability
 - D. Resistance to cutting
- 39.** Zellerfeld have designed their own 3D printers to manufacture the shoes.

Which aspects of a design specification would specify additive manufacturing as a production process for the shoes?

- I. Price constraints
 - II. Manufacturing requirements
 - III. Materials requirements
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

- 40.** Which of Datschefski's five principles of sustainable design applies to the Zellerfeld shoe?
- A. Safe
 - B. Social
 - C. Cyclic
 - D. Solar
-

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References:

- Figure 1:** boana, 2018. *Woman using phone in the subway train – stock photo*. [image online] Available at: <https://www.gettyimages.in/detail/photo/woman-using-phone-in-the-subway-train-royalty-free-image/961748002> [Accessed 28 June 2024].
- Figure 2:** With permission from S4S Technologies.
- Figure 3:** Photo credit Michael Peshkin.
- Figure 4:** S. Omid et al., 2020. Self-expanding stents based on shape memory alloys and shape memory polymers. [pdf] *Journal of Composites and Compounds*. Available at: <https://jourcc.com/index.php/jourcc/article/view/jcc225/55> [Accessed 01 July 2024]. Open access article, licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>. Source adapted.
- art4stock, 2022. *Peripherally inserted central catheter PICC on male body – stock image*. [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/peripherally-inserted-central-catheter-picc-royalty-free-illustration/1410816460> [Accessed 30 October 2025]. Source adapted.
- Figure 6:** With permission from Hinokisoken Co., Ltd.
- Figure 7:** Energy rating labelling in Australia. <https://www.energyrating.gov.au/industry-information/understand-requirements/labelling#:~:text=You%20must%20display%20the%20Energy,and%20freezers%2C%20and%20pool%20pumps>. Commonwealth of Australia, licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>. Source adapted.
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