

STUDENT NUMBER Letter

PRODUCT DESIGN AND TECHNOLOGY

Written examination

Monday 7 November 2022

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	12	12	45
B	9	9	45
			Total 90

- Students are permitted to bring into the examination room: pens, lead and coloured pencils, water-based pens and markers, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.
- No calculator is allowed in this examination.

Materials supplied

- Question and answer book of 17 pages
- Detachable insert for Section B in the centrefold

Instructions

- Detach the insert from the centre of this book during reading time.
- Write your **student number** in the space provided above on this page.
- All written responses must be in English.

At the end of the examination

- You may keep the detached insert.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

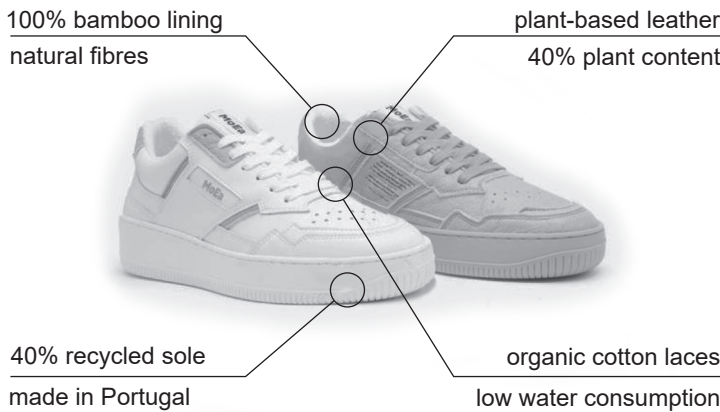
SECTION A

Instructions for Section A

Answer **all** questions in the spaces provided.

Use the following information to answer Questions 1–6.


MoEa sneakers



MoEa sneakers are made from a variety of plant materials.

MoEa is a French sneaker company that diverts plant waste from farming into textile materials used for sneakers. Each sneaker style is made from a different plant material. The MoEa pineapple sneakers are made from pineapple leaves.

- Pineapple leaves are a waste product from farming in the Philippines.
- The pineapple leaves are transported to Italy, where they are processed into fibres and mixed with corn-based PLA (a plastic polymer derived from renewable resources) to create a patented material called Piñatex®.
- The pineapple sneaker uppers use the Piñatex® fabric as plant-based leather.
- Piñatex® is a robust and durable fabric that is certified vegan (suitable for people who do not use or eat animal products).
- When the sneakers' life cycle is complete, the worn sneakers can be returned to the manufacturer to be disassembled and components of the upper part can be composted.



Worker collecting pineapple leaves

Sources: adapted from 'PineappleSkin – MoEa', MoEa, <<https://moea.io/en-au/pages/pineappleskin>> and 'GEN1 – Pineapple Full Yellow – MoEa', MoEa, <<https://moea.io/en-au/products/gen1-pineapple-full-yellow>>

Question 1 (1 mark)

Identify **one** raw material used in the MoEa pineapple sneakers.

Question 2 (6 marks)

- a. Explain how MoEa may have reduced the environmental impact of the end-of-life stage of the life cycle of the MoEa pineapple sneakers. 3 marks

- b. Transportation is one stage in the life cycle of a product.
Evaluate the environmental impact of the MoEa pineapple sneakers in the transportation stage. 3 marks

Question 3 (3 marks)

Discuss **one** benefit of using plant-based materials in sneakers such as the MoEa pineapple sneakers.

Question 4 (6 marks)

Analyse the MoEa pineapple sneakers in relation to the following sustainability frameworks.

- Design for Disassembly (DfD)

- Extended Producer Responsibility (EPR)

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Question 5 (3 marks)

The MoEa pineapple sneakers are an innovative product.

Explain how research and development supports product development.

Question 6 (4 marks)

The manufacturer of MoEa pineapple sneakers could produce these sneakers at a low volume scale.

Discuss reasons for and against choosing this manufacturing scale.

Use the following information to answer Questions 7, 8 and 12.

Sherpa folding garden cart

RRP \$168



This folding cart is very versatile and includes a fold-down end for extra length. It can be folded to fit in a car or store neatly in a garage or shed.

The large, strong wheels make it easy to pull, while the rubber tread helps keep grip and the four-wheel design makes it both stable and easy to move.

The sturdy frame is a steel construction with reinforced joints and is coated for extra durability.

Specifications and features:

- overall dimensions: 95 × 54.5 × 78 cm
- internal dimensions (when expanded): 73 × 45 × 25 cm
- max. load: 150 kg
- weight: 13 kg
- wheel diameter: 20 cm
- wheel width: 8 cm
- handle max. length: 80 cm
- durable removable liner
- bottle/can holder
- one-year warranty



Source: adapted from 'Folding cart with tail gate', Sherpa Tools, <www.sherpatools.co.uk/index.php/products/folding-cart-with-tail-gate/>

Question 7 (6 marks)

The folding cart has been designed with the end user in mind.

- a. Describe the profile of **one** typical end user of the folding cart. 2 marks

- b. Explain **two** ergonomic considerations the designers would have needed to consider in the design of this product for the end user described in **part a**. 4 marks

Question 8 (3 marks)

- a. Identify a risk that may occur during the use of the folding cart. 1 mark

- b. Explain how the end user may reduce or eliminate the risk identified in **part a**. 2 marks

Use the following information to answer Questions 9–12.

Sherpa Power Barrow

RRP \$1610

This high quality, cordless electric wheelbarrow is perfect around the garden, stables and building sites. The tray is mounted using a pivot point, allowing it to be easily tipped.

Designed for easy use and safety, the Power Barrow has adjustable speed and a handbrake for the front wheel.

Specifications and features:

- tray dimensions: 97 × 65 × 37 cm (length × width × front height)
- overall length: 147 cm
- max. load: 150 kg
- large front tractor tyre
- 24 V removable battery
- speed: 0–4 km/h
- steel frame
- tough steel tray
- two-year warranty



Source: adapted from ‘Power Barrow’, Sherpa Tools, <www.sherpatools.co.uk/index.php/products/power-barrow-spb-500/>

Question 9 (3 marks)

Explain how computer-aided design (CAD) could have assisted in the design and development stage and the planning and production stage of the Sherpa Power Barrow.

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Question 10 (4 marks)

Identify and describe **two** legal responsibilities that designers would have needed to consider when designing the Sherpa Power Barrow, other than legal responsibilities to do with intellectual property.

Question 11 (2 marks)

Target market interviews are one-on-one conversations with members of the target market.

Explain how target market interviews could have been used to gather information about user-centred design for the Sherpa Power Barrow.

Question 12 (4 marks)

Bethanie is a 35-year-old nurse. She has two children in primary school and an active outdoor lifestyle. She owns her own home and her home has a large backyard with uneven ground that requires a lot of regular maintenance. Her home also has a well-established vegetable garden, where Bethanie and her children enjoy spending time.

Bethanie needs to buy a new wheelbarrow. She has been considering the folding cart on page 6 and the Sherpa Power Barrow on page 8 and comparing their different features.

- a. Identify the product that Bethanie should purchase. 1 mark

- b. Justify your response to **part a.** by comparing the two products and by explaining **two** attributes of each product, excluding price, that Bethanie may value most. 3 marks

SECTION B**Instructions for Section B**

Please remove the insert from the centre of this book during reading time.
 Use the material provided in the insert to answer the questions in this section.
 Answer **all** questions in the spaces provided.

Tick (✓) one product from the list below. Use this product to answer the questions that follow.

Product	
single bike rack launch station	
cycling outer garment (unisex top)	

Question 1 (8 marks)

Complete the table below by describing a process that could be used to evaluate the success of the product for each of the evaluation questions.

Evaluation question	A process that could be used to evaluate the success of the product
Does the product allow for use in multiple weather conditions?	
Is the product durable?	
Are the colours used on the product easy to see?	
Is the product innovative?	

Question 2 (3 marks)

Identify one user-centred design parameter and explain two reasons why this parameter is relevant to the product you will be designing.

Design parameter _____

Reason 1 _____

Reason 2 _____

Question 3 (4 marks)

The product needs to be suitable for use in multiple weather conditions.

Tick (✓) which material category you will predominantly use in your product.

Material category	
wood, metal and/or plastic	
textiles	

Name one specific material, identify which part of your product this material is intended for and explain what properties make this material suitable.

Specific material _____

Part of the product _____

Explanation _____

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Question 4 (4 marks)

Name a production process that you could use with the specific material named in Question 3.

Production process _____

- a. Name **one** main tool or equipment required to perform this production process. 1 mark

- b. Outline **three** main steps of this production process. 3 marks

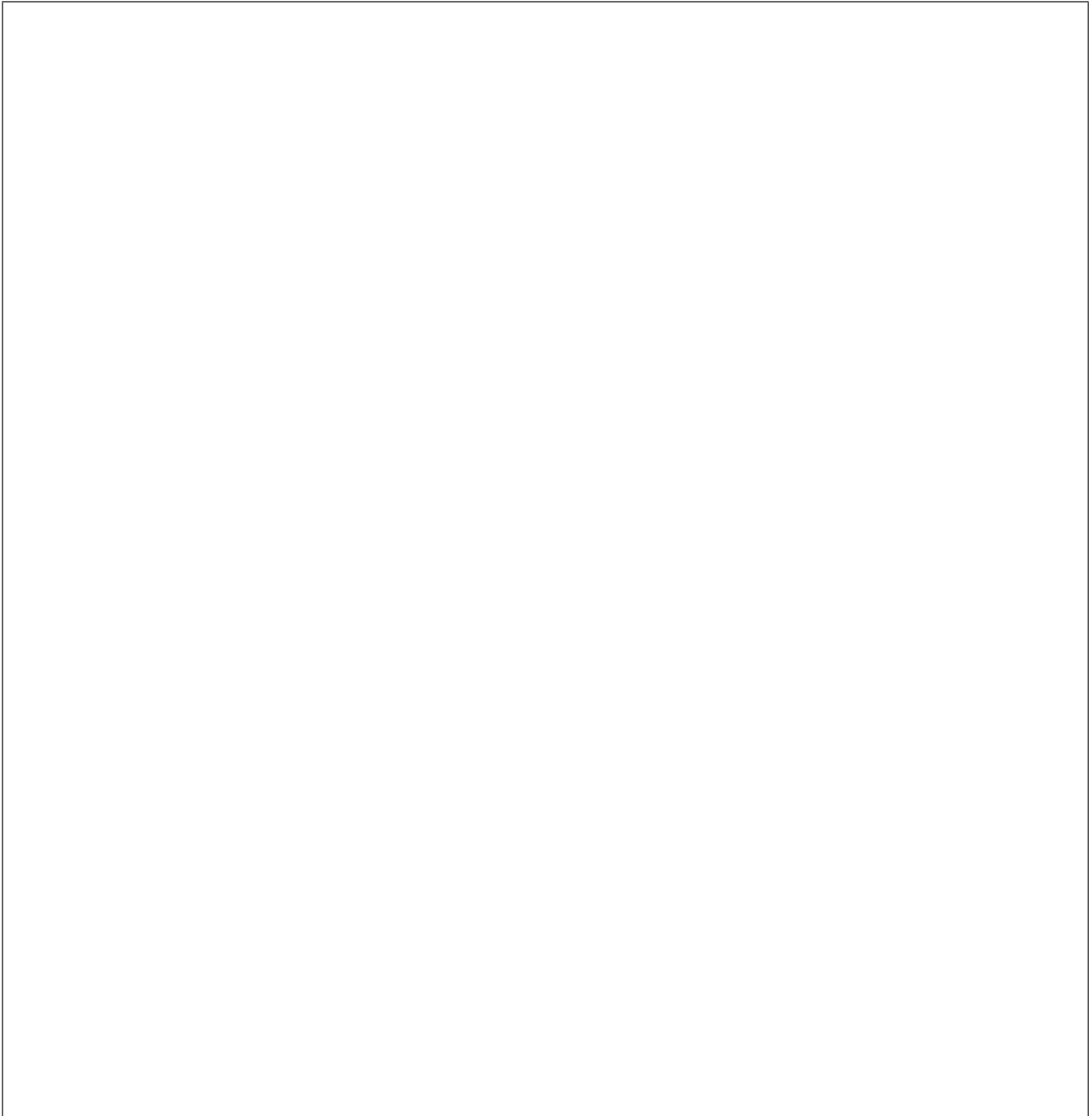
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Question 5 (12 marks)

Draw **one** design option (presentation drawing) for your product design in the box below. This drawing should provide enough detail to clearly show what the whole product will look like.

Your response to this question will be assessed against the following assessment criteria.

1	use of visual, tactile and aesthetic parameters (design elements and principles) in the design	4 marks
2	four annotations to explain how the functional and suitability requirements have been met	4 marks
3	innovation and creativity	2 marks
4	clarity and detail	2 marks



Question 6 (4 marks)

Based on your design option (presentation drawing) from Question 5, in the box below draw an exploded view (close-up drawing) of a detail of the product to communicate or highlight a requirement of the design brief.

Your response to this question will be assessed against the following assessment criteria.

1	clarity of the exploded view	2 marks
2	suitability of the detail for the intended use of the product	2 marks



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Question 7 (3 marks)

New and emerging technologies play a key role in the design and development of new products.

Identify a new and emerging technology, other than CAD, that could be used in the design and development of your product and analyse how it could be used.

Question 8 (3 marks)

The organisers of the Lake Triathlon would like to see a high-quality prototype of your product prior to its manufacture.

Discuss the purpose of creating a prototype of your product.

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Question 9 (4 marks)

Discuss **two** techniques to record or report process and modifications of production activities.

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Insert for Section B

Please remove from the centre of this book during reading time.

Design scenario

The annual Lake Triathlon takes place at a different location in Victoria each summer. A triathlon is an event that requires participants to swim, cycle and then run various distances.

The activities in the Lake Triathlon are a lake swim, road ride and forest run. It is a competitive event, with participants racing against each other and aiming to beat their own personal best time. There is also a category for para-athletes (athletes with a physical disability) to compete in.

Quick-change clothing and a smooth transition of equipment at the turnover of each activity are essential in keeping times down. For the cycling section, bikes are placed into a rack. When a competitor is on their bike and ready to begin cycling, the bike is launched from the rack.

The planning committee of the Lake Triathlon event is seeking submissions for designs of products that can be used at the 2023 Lake Triathlon. The event organisers would like the products to be inspired by the natural environment and include colours suitable for increased visibility.

The weather will most likely be hot and sunny for the Lake Triathlon but provisions for wind and rain must also be considered.

The products must:

- allow for multiple weather conditions – including sun, wind and rain
- be durable
- include colours suitable for increased visibility
- be innovative and creative
- cater for para-athletes (athletes with a physical disability) to participate unaided.

Select **one** product from the list below.

Product 1

Single bike rack launch station
<ul style="list-style-type: none">• includes design feature(s) that will enable a para-athlete with a full or partial limb amputation to easily access and release the bike
<ul style="list-style-type: none">• is able to be part of a modular system (can join to other bike racks)
<ul style="list-style-type: none">• has a strong, stable base to hold the weight of the bike and its rider

Product 2

Cycling outer garment (unisex top)
<ul style="list-style-type: none">• includes design feature(s) to ensure a quick change before the road ride
<ul style="list-style-type: none">• has a method of securely storing sunglasses, as well as a pocket
<ul style="list-style-type: none">• includes design feature(s) suitable for a para-athlete with a full or partial arm amputation