

SUPERVISOR TO ATTACH  
PROCESSING LABEL HERE

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Write your **student number** in the boxes above.

**Letter**

# Product Design and Technologies

## Question and Answer Book

VCE Examination – Day Date Month Year

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- Reading time is **15 minutes**: — to —
- Writing time is **1 hour 30 minutes**: — to —

### Approved materials

- Coloured pencils, water-based pens and markers

### Materials supplied

- Question and Answer Book of 20 pages

### Instructions

- Answer **all** questions in the spaces provided.
- Write your responses in English.

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

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<b>Contents</b>	pages
9 questions (90 marks)	2–17

**Question 1** (9 marks)

Positive ageing embraces the idea of being active, connected, valued and respected as you grow older in your community.

Social participation is a vital component of positive ageing. Social isolation can have a major impact on health and wellbeing within the ageing community.

Recommendations to reduce social isolation and loneliness among older people include:

- promoting meaningful roles for older people within the community
- increasing opportunities for older people to join, attend and participate in existing clubs, groups, organisations or activities
- increasing older people’s knowledge of the importance of maintaining and strengthening their levels of participation
- addressing personal mobility and local transport issues by building on existing networks.

Source: adapted from [www.mornpen.vic.gov.au/Community-Services/Aged-Disability-Support/Peninsula-Advisory-Committee-for-Elders-PACE](http://www.mornpen.vic.gov.au/Community-Services/Aged-Disability-Support/Peninsula-Advisory-Committee-for-Elders-PACE), p. 3 and p. 20

**Figure 1**

- a. One activity in the first diamond of the Double Diamond design process is ‘Investigating and defining’.

Using the information in Figure 1, explain how the purpose of ‘Investigating and defining’ is used to develop an end user profile.

2 marks

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- b. Using the information in Figure 1, explain **one** ethical research method to develop an end user profile or identify the end user’s needs or opportunities.

3 marks

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- c. Designers employ various activities and thinking techniques to gather feedback to determine if a product successfully meets the needs of an end user.

Describe **one** critical thinking technique relevant to the 'Generating and designing' activity in the second diamond of the Double Diamond design approach that would be appropriate for the positive ageing strategy.

2 marks

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- d. Explain how this critical thinking technique could assist to successfully gather feedback from end users to justify a final proof of concept.

2 marks

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**Question 2** (7 marks)

RMIT University researchers have developed a solution that can use disposable healthcare materials or personal protective equipment (PPE) like masks, gloves and isolation gowns as a strengthening ingredient for concrete. Concrete is a composite material commonly used in construction that is composed of a mixture of cement, water, and sand or gravel. Shredded PPE could increase the strength of concrete by up to 22% and improve its durability and resistance to cracking.

Source: [www.rmit.edu.au/news/all-news/2022/august/ppe-concrete](http://www.rmit.edu.au/news/all-news/2022/august/ppe-concrete)

**a.** Describe **one** potential benefit or improvement that incorporating recycled PPE in concrete may offer to the following industries.

**i.** Construction industry

2 marks

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**ii.** Healthcare industry

2 marks

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**b.** Explain how researchers at RMIT University may have worked technologically to research and test the physical product concept of 'recycled PPE-strengthened concrete'.

3 marks

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**Question 3** (14 marks)

Play gives children different sensory, physical and cognitive experiences. These experiences build connections in the brain, which helps children develop physically, cognitively, socially and emotionally.

Source: [www.raisingchildren.net.au/newborns/play-learning/play-ideas/why-play-is-important](http://www.raisingchildren.net.au/newborns/play-learning/play-ideas/why-play-is-important)

A child's rattle is a specially designed toy intended to entertain them. For thousands of years, rattles have served this purpose, and child development specialists argue that they enhance hand-eye coordination in children by engaging their sensory perception.

**An Aboriginal child's rattle from 1899**



Photograph: Rebecca Fisher © Australian Museum

Rattle made from shells strung together with string made from fibre. The string is threaded through holes drilled in the shells.

Materials: shells, handspun bark fibre

Source: [www.australian.museum/learn/cultures/atsi-collection/aboriginal-toys/toys-for-infants/#gallery-2](http://www.australian.museum/learn/cultures/atsi-collection/aboriginal-toys/toys-for-infants/#gallery-2)

**Figure 2**

**A child's rattle from 2023**



Rattle made from timber, silicone and metal. The timber used is pine, which is tested to comply with Australia's regulations for child safety. The paints used on the products are tested separately to guarantee that they are non-toxic.

Materials: silicone, pine, metal, non-toxic paint

Source: Image of Patterned Hand Cluster Handbell, by Kaper Kidz, originally reproduced on Eleganter Australia website, [www.eleganteraustralia.com.au](http://www.eleganteraustralia.com.au), 2023

**Figure 3**

- a. Aesthetics and function are two factors that influence product design. Use these two factors to discuss how they may have influenced the design of both rattles. 4 marks

Rattle 1

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Rattle 2

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- b. When making products, designers may use design thinking techniques to evaluate the selection of materials, tools and processes.  
Identify **one** creative thinking technique and describe **one** way that designers may have used this technique when designing rattles. 3 marks

Creative thinking technique \_\_\_\_\_

Description \_\_\_\_\_

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c. Select **one** material used in the construction of a rattle from Figure 2 or Figure 3.

Material \_\_\_\_\_

i. Evaluate why this material might have been chosen for the rattle's construction with regard to ethical considerations.

4 marks

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ii. Discuss **one** impact on the environment of using this material to make a rattle.

3 marks

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**Question 4** (6 marks)

Toy designers need to think speculatively and innovate to remain competitive in the global market. An example of speculative thinking could be considering how the design of toys could adapt and evolve over time, providing a continuous and dynamic play experience for children as they grow older.

**a.** Describe speculative thinking.

2 marks

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**b.** Discuss how speculative thinking and innovation may relate to entrepreneurial activities in toy design.

4 marks

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**Question 5** (7 marks)

Composite metals are mixtures of metals that can be used in metal 3D printing. These composite metals significantly influence the final product. For example, sterling silver, marked as 925, is a blend of silver and copper or zinc. Designers may experiment with various composite metals for specific purposes when 3D printing.

- a. Describe **one** reason why designers may experiment with various composite metals in 3D printing.

2 marks

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- b. Describe **one** advantage of experimenting with alternative materials in production processes.

2 marks

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- c. Critique **one** impact of using composite metals for the end user.

3 marks

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**Question 6** (28 marks)

The following five reviews were collected from an online site selling the tea flask below.



**Tea flask \$9.95**

Source: Roman Samsonov/Shutterstock.com

**Review 1 from Jazzy:** Keeps tea hot for a decent time; simple design but no stand-out features. Lid works well but lacks the finesse of pricier products. A non-slip base would be useful to prevent accidental spill and a wider opening for cleaning. Budget-friendly and gets the job done.



**Review 2 from TeaLover:** Exceeded my expectations! Simple design that maintains perfect tea temperature all day. Love it!



**Review 3 from Sheridan2002:** OK performance, but would like to see an improved opening for easier pouring of hot tea.



**Review 4 from Vanilla:** Great for on-the-go, but a stronger, more comfortable handle would make it easier to carry around.



**Review 4 from EarlGrey:** Easy to use but comes with no cup!



**Figure 4**

- a. Describe what is quantitative data and what is qualitative data and provide an example of each type of data in relation to Figure 4. 4 marks

	Quantitative data	Qualitative data
Description		
Example		

- b. i. Identify the type of source from which the data in Figure 4 has been gathered. 1 mark

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- ii. Describe another way to use this source of data. 2 marks

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- c. Describe **one** example of ethical research evident in the data collected on the tea flask. 2 marks

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- d. Use the data in Figure 4 to identify **one** improvement to the tea flask and justify your reasoning for this improvement. 4 marks

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SAMPLE

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e. Draw two visualisations of the improvement identified in **part d**.

6 marks

Visualisation 1

Visualisation 2

f. Select one visualisation. Identify **one** feature from this visualisation that could be prototyped prior to production and explain **one** benefit of prototyping this feature for the manufacturer.

2 marks

Tick one of the boxes below to select a visualisation.

Visualisation 1 or  Visualisation 2

Feature to be prototyped \_\_\_\_\_

Benefit \_\_\_\_\_

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**g.** Explain **one** reason why prototypes are developed.

2 marks

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**h.** Using the tea flask as an example, explain the relationship between the following three terms:

- prototype
- chosen proof of concept
- final proof of concept.

5 marks

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Use the following information to answer questions 7–9.

### UPtex – made by UPPAREL

UPPAREL is Australia and New Zealand’s leading textile recycling company. One of the ways they recycle textiles is by collecting clothing, linen and other textiles that are no longer fit for reuse, thus diverting them from landfill and transforming them into a revolutionary material called UPtex.

UPtex can replace conventional materials such as cardboard, polyurethane foam, PET plastics and fibreglass.

UPtex can be used in a wide variety of applications including signage, homewares (e.g. cushions, office partitions, upholstery and furniture), acoustic panelling and packaging. It can also be printed, laser cut, die cut, folded or stitched, and is available in different densities and thicknesses. It is weather-resistant and can handle outdoor conditions without warping or distorting.

When an UPtex product reaches its end of life, it can be returned to UPPAREL and recycled all over again, resulting in zero waste and supporting a circular economy.



Source (text): adapted from <https://upparel.com.au/uptex/>  
 Source (photos): [www.planetark.org/newsroom/news/upparel-launches-completely-recycled-and-recyclable-textile-material](http://www.planetark.org/newsroom/news/upparel-launches-completely-recycled-and-recyclable-textile-material)  
 Images © Upparel; reproduced by permission

Figure 5

**Question 7 (7 marks)**

- a.** Describe what is meant by the term 'circular economy' as a sustainability framework. 2 marks

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- b.** Using the information in Figure 5, discuss **two** ways that a circular economy framework has been adopted to manufacture UPtex. 5 marks

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**Question 8** (6 marks)

- a. Describe what is meant by the term 'planned obsolescence'. 2 marks

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- b. Analyse the impact of the manufacture of UPtex with regard to planned obsolescence and sustainability. 4 marks

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**Question 9** (6 marks)

Compare the implementation of a lean manufacturing approach in UPtex to that of a flexible or responsive manufacturing approach. In your comparison, identify **one** similarity and **one** difference between these two manufacturing approaches.

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