OCR
Oxford Cambridge and RSA

Monday 15 May 2023 – Afternoon

AS Level in Design and Technology: Product Design

H006/01 Principles of Product Design

Time allowed: 1 hour 45 minutes

8931658181

You can use:
- a ruler (cm/mm)
- a scientific calculator
- geometrical instruments

H006/01

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question numbers.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

1 A snorkel and mask are worn in shallow water. This allows the user to see clearly and breathe just below the surface of the water.

Fig. 1.1 and **Fig. 1.2** show a separate mask and snorkel.

Fig. 1.1

Fig. 1.2

Fig. 1.3 and **Fig. 1.4** show a full face snorkel where the snorkel and mask are combined.

Fig. 1.3

Fig. 1.4

(a) Compare the separate mask and snorkel shown in **Fig. 1.2** with the full face snorkel shown in **Fig. 1.4**.

(i) Identify **two** reasons why the user might prefer a separate mask and snorkel.

Justify **each** of your answers.

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(ii) Identify **two** reasons why the user might prefer a full face snorkel.

Justify **each** of your answers.

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(b) The design of the separate mask and snorkel was developed into the full face snorkel as a result of investigating stakeholder requirements.

(i) Identify **two** specific methods that could be used to investigate stakeholder requirements.

For **each** method, describe how it could contribute to the development of the full face snorkel.

Method .....

How it could contribute .....

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Method .....

How it could contribute .....

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(ii) Identify and describe **two different** digital modelling tools that could be used in the development of the full face snorkel.

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(c) The development of new products is often influenced by market trends.

Discuss how market trends can influence specific aspects of the design of products.

Use examples of products in your answer.

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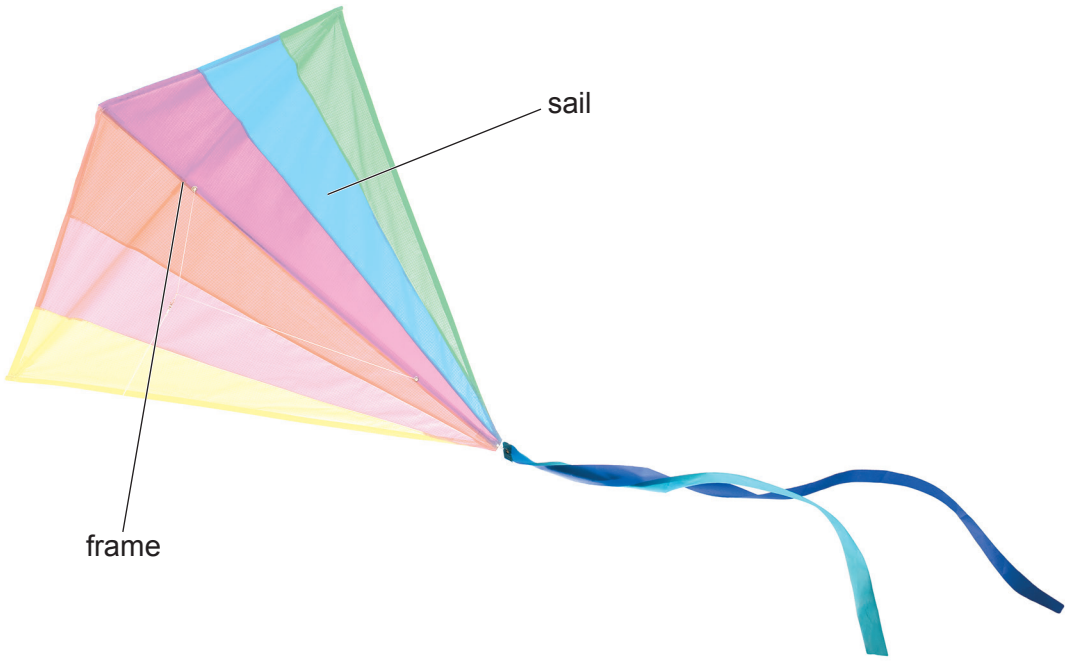
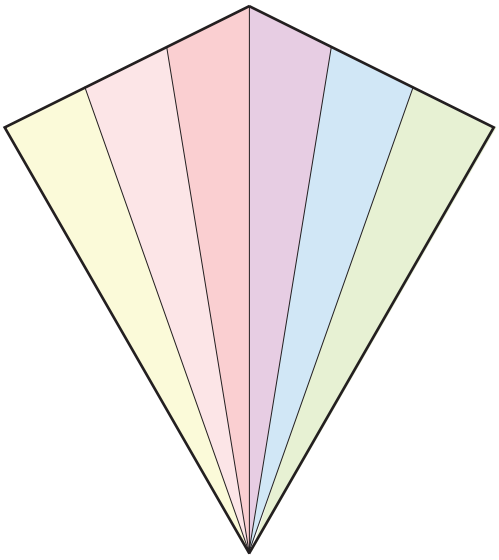
2 This is a kite. A kite is designed to be flown in the air. It uses a fabric sail stretched over a frame to catch the wind and fly.



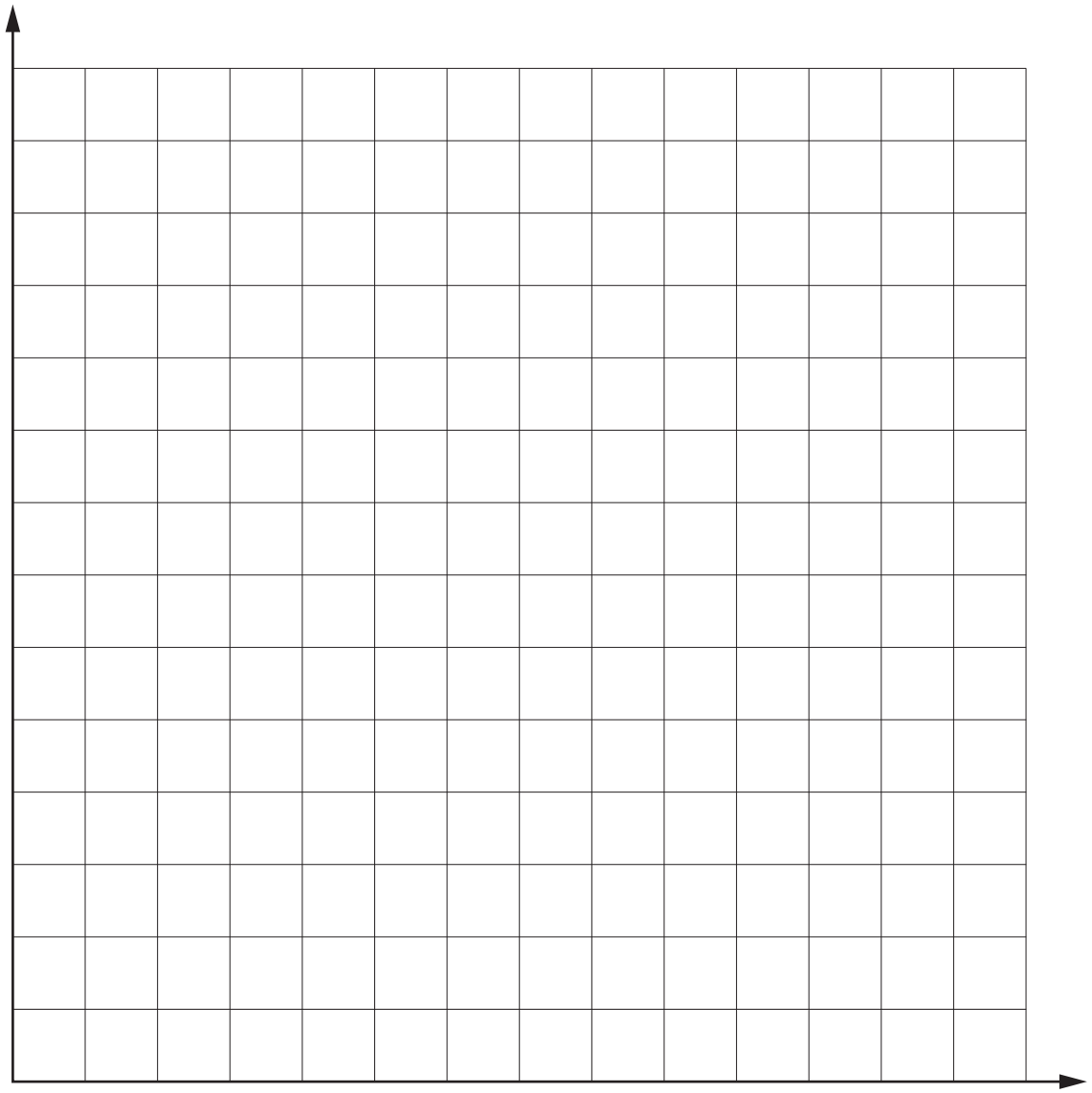
This is the kite sail.



(a) The shape of the kite sail is a quadrilateral.

The vertices of the quadrilateral ABCD are A (4,10), B (8,12), C (12,10) and D (8,3).

(i) Use this information to plot the quadrilateral on the grid below. **[1]**



(ii) Calculate the gradient of line AB. Show your working. **[2]**

Gradient of line AB .....

(iii) The grid in **part (a)(i)** is 1-centimetre grid paper.

Calculate the length of line AB. Give your answer in cm to **2** decimal places. Show your working. **[3]**

Length of line AB .....cm

(iv) The quadrilateral in **part (a)(i)** is drawn to a scale of 1:10.

Calculate the surface area of the fabric needed to cover the **upscaled** quadrilateral. Give your answer in cm^2. Show your working. **[4]**

Surface area of fabric .....cm^2

(b) A number of prototypes of the kite were tested. They produced the following probability results:

Issue A: The probability of the frame breaking = 0.06

Issue B: The probability of the fabric ripping = 0.009

(i) Calculate the probability that a kite, chosen at random, will have either Issue A or Issue B. **[1]**

Probability .....

(ii) A batch of 1000 kites has been produced.

Calculate how many kites are likely to be affected by the probability of Issue A occurring within this batch. **[1]**

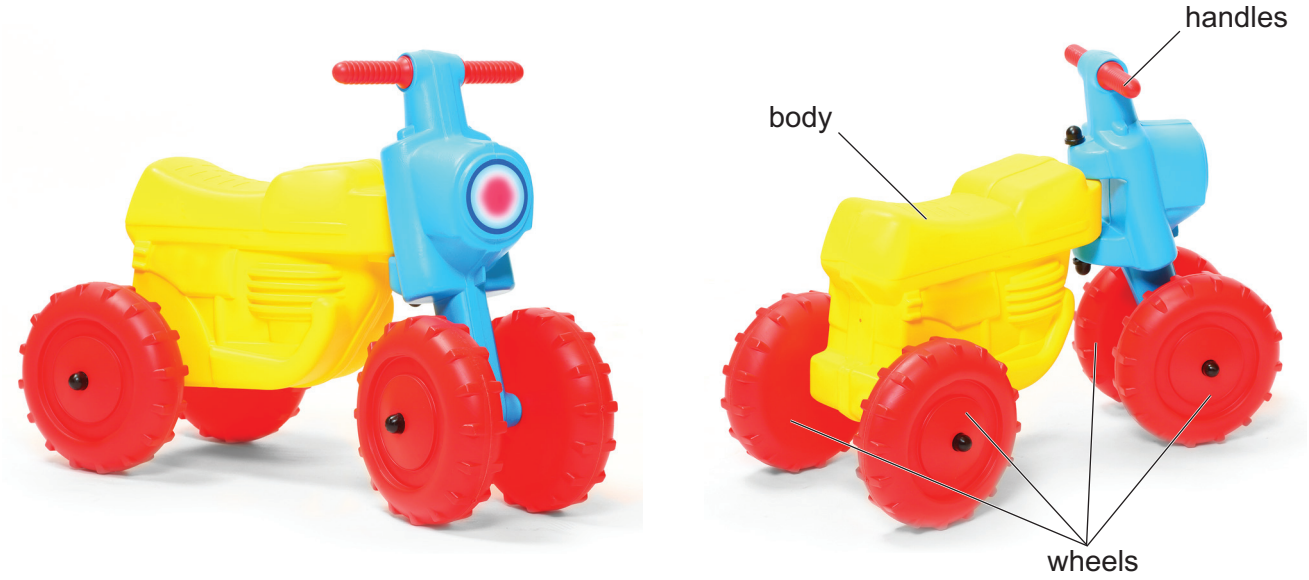
Number of kites .....

(iii) 10 kites are selected from the batch of 1000 and are tested.

Use your answer to **part (b)(ii)** to calculate the probability that all 10 kites are faulty with Issue A, given that the first kite is faulty. Show your working. **[2]**

Probability .....

3 These are **two** views of a ride-on toy motorcycle for small children.



(a) The toy motorcycle is manufactured from a thermoplastic.

(i) Identify a suitable thermoplastic for the toy motorcycle.

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(ii) Identify **one** property of the thermoplastic you have identified in **part (a)(i)** that makes it suitable for the toy motorcycle.

Justify your answer.

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(b) Identify a suitable commercial process for the manufacture of the toy motorcycle **body**.

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(c) Use annotated sketches and/or notes to show how the toy motorcycle would be manufactured as a batch of 4000 from a thermoplastic.

Identify any relevant manufacturing processes and assembly methods. **[8]**

(d) Robotic arms and automated systems could be used in the production process of the toy motorcycle.

Identify and explain **two** advantages and **one** disadvantage of using robotic arms and automated systems in the production process of the toy motorcycle.

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Advantage .....

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Disadvantage .....

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4 This is a robotic vacuum cleaner and its charging dock. The robotic vacuum cleaner can be programmed to clean each room of a house. The robotic vacuum cleaner will self-navigate obstacles and brush/remove dirt from the floor.

These are images of the robotic vacuum cleaner in use.

Image A

Image A: shows the robotic vacuum cleaner in the charging dock.

Image B: shows the lifted lid and removable dust compartment.

Image C: shows the underside of the robotic vacuum cleaner.

Image B

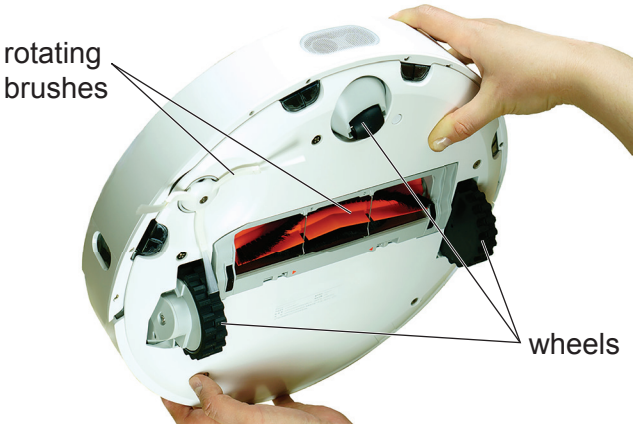

Image C

(a) Identify **three** advantages of using the robotic vacuum cleaner over a traditional upright vacuum cleaner.

Justify **each** of your answers.

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(b) Analyse the design of the robotic vacuum cleaner.

(i) Identify **three** potential problems relating to the functionality of the design that the designer had to solve.

Suggest how the designer could have solved **each** problem.

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(ii) Explain, using examples, **two** ways in which the designer of the robotic vacuum cleaner considered its 'end of life'.

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(c)* Smart technologies are being used increasingly in people's homes.

Discuss the implications of using smart technologies in the home.

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5 Designers need to consider the source of materials when designing products.

(a) Explain the difference between a social footprint and an ecological footprint.

Use examples in your answer.

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(b)* Discuss how synthetic and natural materials are selected with consideration of their social and ecological footprints.

Use specific materials and products in your answer.

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END OF QUESTION PAPER

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