OCR
Oxford Cambridge and RSA

# Monday 16 May 2022 – Afternoon

## AS Level in Design and Technology: Product Design

**H006/01** Principles of Product Design

**Time allowed: 1 hour 45 minutes**

*8221593385*

**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 **24** pages.

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

Answer **all** the questions.

**1** **Fig. 1.1** shows a hardwood step stool.

**Fig. 1.1**

**(a)** **(i)** Name a suitable hardwood for the step stool.

..... **[1]**

**(ii)** State **two** properties of the material you have identified in **part (a)(i)** that make it suitable for the step stool.

Justify **each** of your answers.

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**[4]**

**(b)** The step stool is manufactured so that it can be bought as a flat pack and assembled at home.

**Fig. 1.2** shows an exploded diagram of the step stool framework.

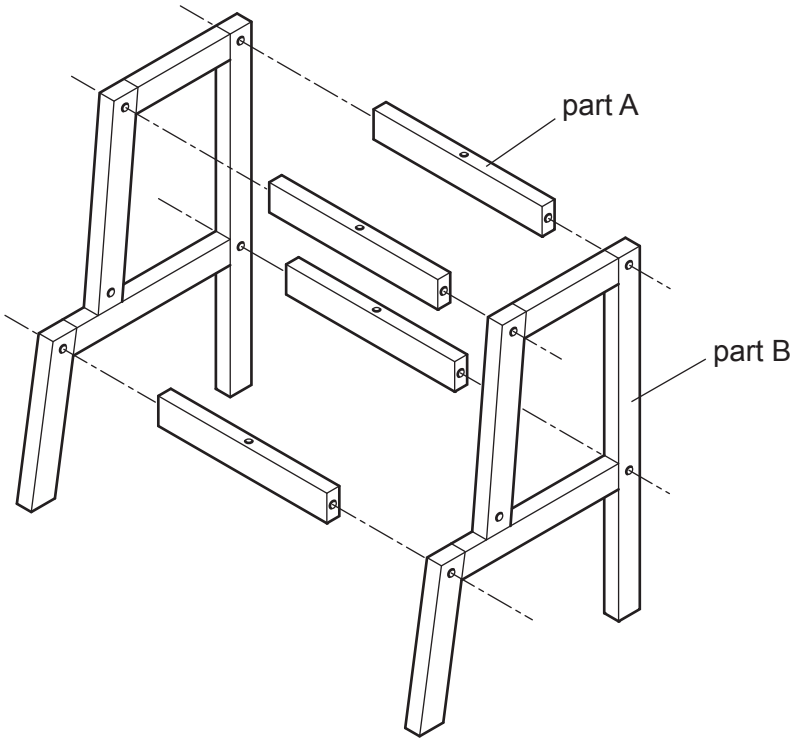


**Fig. 1.2**

**(i)** Identify a suitable standard fixing or component that could be used to join part A to part B as shown in **Fig. 1.2**.

..... **[1]**

**(ii)** Give **two** benefits to the manufacturer of using standard fixings or components.

Justify **each** of your answers.

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**[4]**

**(c) (i)** Identify **two different** types of jig that could be used in the manufacture of the step stool.

For **each** type of jig state **one** way in which it would be used in the manufacturing process.

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**[4]**

**(ii)** Discuss the importance of jigs in commercial production.

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**[6]**

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**2** **Fig. 2.1** and **Fig. 2.2** show a fitness tracker. A fitness tracker is a wearable device that records the user's physical activity and other health-related data.


**Fig. 2.1**

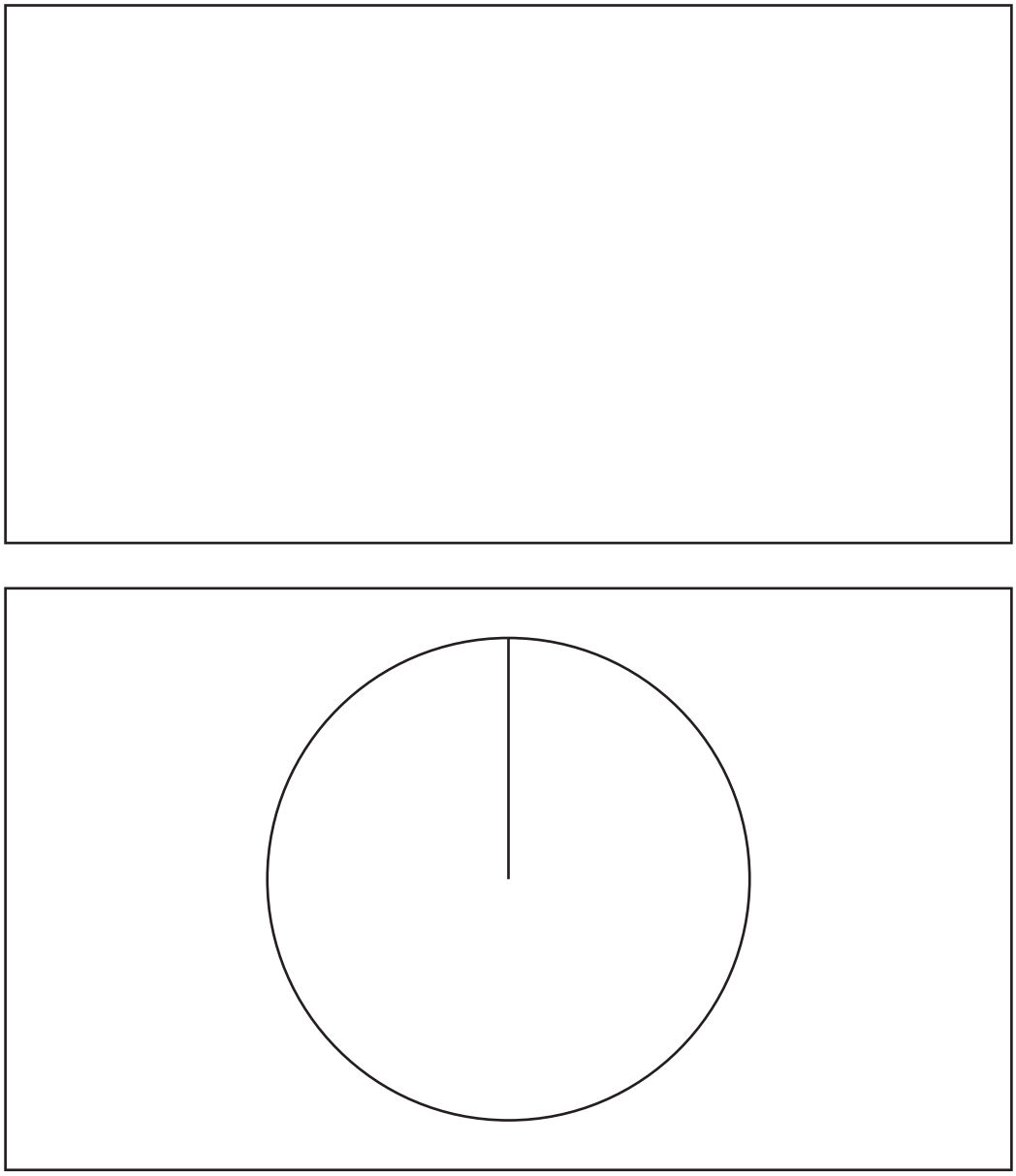
**Fig. 2.2**

**(a)** **Table 2.3** shows data that has been collected from a survey of 800 people asking the main reason why they use fitness trackers.

| Reason | Number of people |
|---|---|
| A: To improve fitness | 400 |
| B: To improve sleep | 200 |
| C: To lose weight | 100 |
| D: To train for an event | 75 |
| E: Other reason | 25 |

**Table 2.3**

Use the template below to present the data given in **Table 2.3** as a pie chart. Show your working. **[3]**



**(b)** The fitness tracker is to be adapted for teenagers.

**Table 2.4** shows a sample of anthropometric data collected for children's wrists.

**Fig. 2.5** shows an illustration of the fitness tracker strap.

| **Wrist percentile values (cm) for 13–18 year olds** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Percentile** | | **3rd** | **5th** | **10th** | **25th** | **50th** | **75th** | **85th** | **90th** | **95th** | **97th** |
| **Girls** | **Age** | | | | | | | | | | |
| | **13** | 13.4 | 13.6 | 14.0 | 14.7 | 15.3 | 16.0 | 16.4 | 16.7 | 17.1 | 17.4 |
| | **14** | 13.8 | 13.9 | 14.2 | 14.8 | 15.4 | 16.1 | 16.6 | 16.8 | 17.3 | 17.5 |
| | **15** | 13.9 | 14.1 | 14.4 | 14.9 | 15.6 | 16.2 | 16.6 | 16.9 | 17.3 | 17.6 |
| | **16** | 13.9 | 14.1 | 14.4 | 14.9 | 15.6 | 16.2 | 16.7 | 17.0 | 17.4 | 17.8 |
| | **17** | 13.9 | 14.1 | 14.4 | 14.9 | 15.6 | 16.3 | 16.8 | 17.0 | 17.5 | 17.8 |
| | **18** | 13.9 | 14.1 | 14.4 | 15.0 | 15.7 | 16.4 | 16.9 | 17.2 | 17.7 | 18.1 |
| **Boys** | **Age** | | | | | | | | | | |
| | **13** | 13.6 | 13.9 | 14.2 | 14.9 | 15.7 | 16.5 | 17.0 | 17.3 | 17.8 | 18.1 |
| | **14** | 14.0 | 14.3 | 14.7 | 15.2 | 16.0 | 16.7 | 17.2 | 17.5 | 18.0 | 18.3 |
| | **15** | 14.3 | 14.6 | 14.9 | 15.5 | 16.2 | 16.9 | 17.3 | 17.6 | 18.0 | 18.3 |
| | **16** | 14.6 | 14.8 | 15.1 | 15.7 | 16.4 | 17.1 | 17.4 | 17.7 | 18.1 | 18.3 |
| | **17** | 14.7 | 14.9 | 15.3 | 15.9 | 16.5 | 17.2 | 17.6 | 17.8 | 18.2 | 18.4 |
| | **18** | 14.8 | 15.0 | 15.4 | 16.0 | 16.7 | 17.3 | 17.7 | 17.9 | 18.3 | 18.6 |

**Table 2.4**

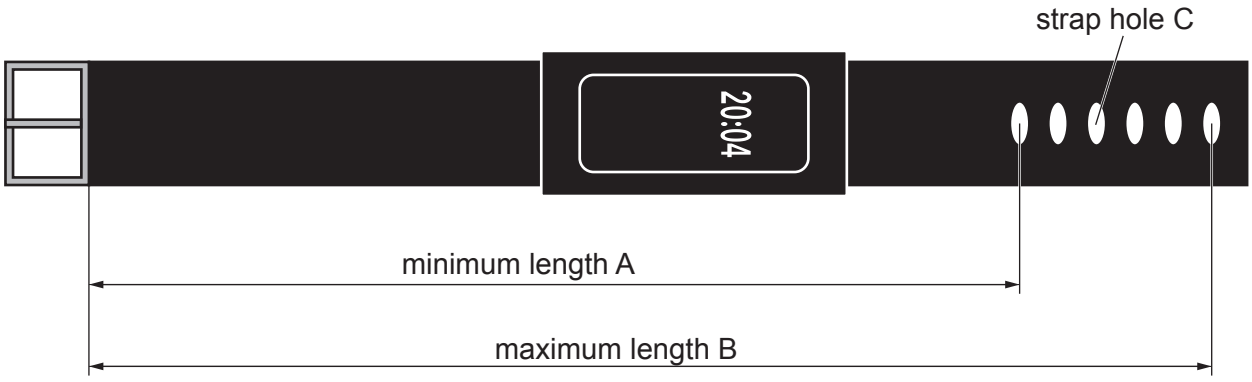



**Fig. 2.5**

**(i)** Use **Table 2.4** to identify the minimum length A and maximum length B of the fitness tracker strap if it was made to fit most girls and boys aged 13–18.

Minimum length A .....cm

Maximum length B .....cm

**[1]**

**(ii)** **Fig. 2.5** shows six strap holes equally spaced. Calculate the length of the fitness tracker strap in cm to **2** decimal places if the user sets it to strap hole C. Show your working. **[3]**

Length of fitness tracker strap .....cm

**(c)** The fitness tracker can be programmed to calculate steps and step goals.

**Fig. 2.6** shows a graph that links the resting heart rate to the average step count per day.

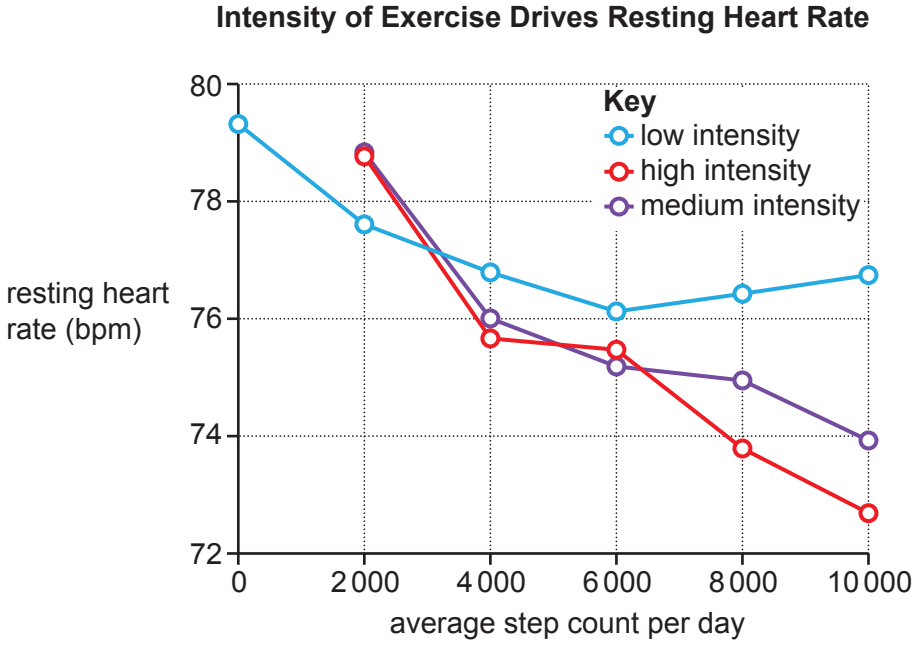



**Fig. 2.6**

Use **Fig. 2.6** to identify the optimum average step count a low intensity walker needs per day to reduce their resting heart rate.

Optimum average step count ..... **[1]**

**(d)** To calculate a female stride length in cm:

Height (cm) × 0.413

A 156 cm-tall female takes 10 000 strides. Use the information above to calculate the distance she has travelled in km to **2** decimal places. Show your working. **[3]**

Distance .....km

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**3** **Fig. 3.1** shows a metal container (part A) with an integral hinged lid (part B).


**Fig. 3.1**
(not to scale)

**(a)** The container shown in **Fig. 3.1** is manufactured from sheet metal.

Name a suitable sheet metal for the container.

Justify your answer.

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..... **[2]**

**(b)** Use annotated sketches and/or notes to show how part A of the container shown in **Fig. 3.1** would be manufactured as a batch of 80 000 from sheet metal.

Identify any relevant equipment, machinery and materials. **[8]**

**(c)** Use annotated sketches and/or notes to show how the blue surface finish shown in **Fig. 3.1** would be applied to the outer surface of the batch of 80 000 containers.

Identify any relevant equipment, machinery and materials. **[6]**

**(d)** Explain the reasons for undertaking risk assessments during the manufacturing processes described in **part (b)** and **part (c)**.

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..... **[3]**

**4** **Fig. 4.1** shows a multi-tool. A multi-tool is a small device that incorporates several fold-out tools in one product.

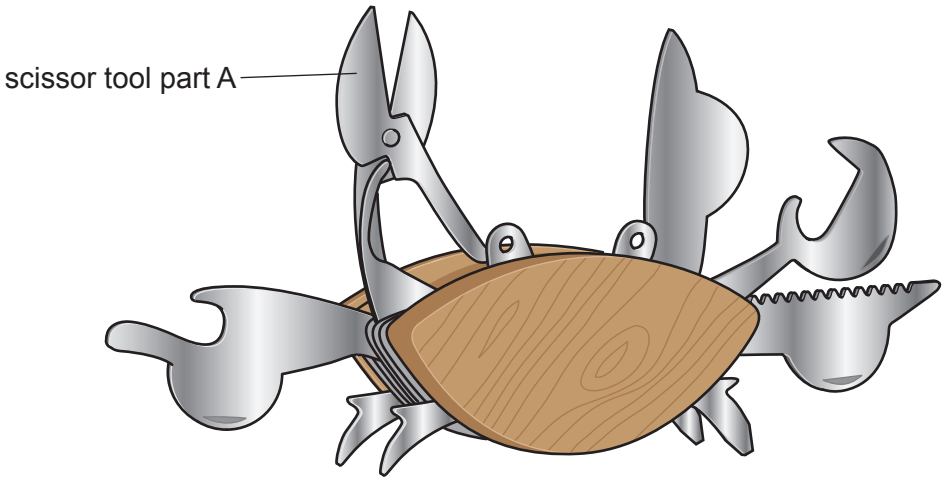


**Fig. 4.1**

**(a)** Identify **two** features of the multi-tool shown in **Fig. 4.1** that enhance its aesthetic appeal.

Justify **each** of your answers.

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**[4]**

**(b)** Identify **two** features of the multi-tool shown in **Fig. 4.1** that enhance its usability.

Justify **each** of your answers.

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**[4]**

**(c)** The scissor tool part A shown in **Fig. 4.1** is made from a ferrous metal.

**(i)** State a suitable ferrous metal for the scissor tool part A.

..... **[1]**

**(ii)** Identify and describe a suitable industrial process that could be used to manufacture the scissor tool part A.

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**(d)** The designer of the multi-tool conducted a survey of 800 people to determine an appropriate price range for the product.

Complete **Table 4.2** below to calculate:

**(i)** how many people chose each price range. **[1]**

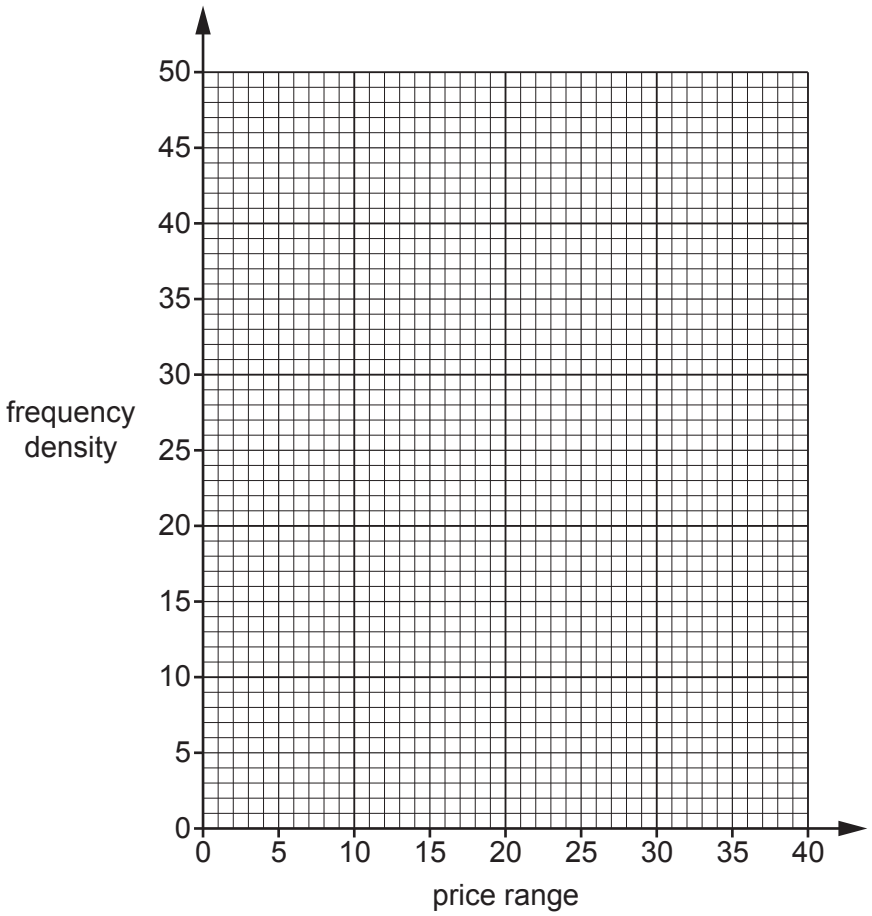
**(ii)** the frequency density for each price range. **[1]**

Show your working.

| Price range (£) (*p* price) | People surveyed (%) | Number of people (frequency) | Class width | Frequency density |
|---|---|---|---|---|
| **0 ≥ p ≤ 5** | 6 | | | |
| **5 > p ≤ 10** | 31 | | | |
| **10 > p ≤ 20** | 43 | | | |
| **20 > p ≤ 40** | 20 | | | |

**Table 4.2**

**(iii)** Draw a histogram on the grid below to represent the information you calculated in **part (d)(ii)**. **[1]**




**(iv)** Identify **two other** methods of exploring stakeholder requirements and describe when **each** method would be used in the iterative design process.

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**[4]**

**(e)*** The design of today's products is often influenced by historical design movements, designers and their methods.

Identify a specific designer and discuss how their work and methods have influenced developments in product design.

Refer to specific examples in your answer.

Chosen designer .....

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**5** **(a)** Describe **three** ways in which planned obsolescence is designed into products.

Refer to specific products in your answer.

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**[6]**

**(b)*** Discuss the impact of planned obsolescence on the environment.

Refer to specific examples in your answer.

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