Modified Enlarged 18pt

# OXFORD CAMBRIDGE AND RSA EXAMINATIONS

## Friday 5 June 2020 – Morning

## A Level in Design and Technology: Product Design

## H406/01 Principles of Product Design

**Time allowed: 1 hour 30 minutes**
**plus your additional time allowance**

**YOU CAN USE:**
**a ruler (cm/mm)**
**a scientific calculator**
**geometrical instruments**

**Please write clearly in black ink.**

**Centre number** | | | | | |

**Candidate number** | | | | |

**First name(s)** _____

**Last name** _____

## READ INSTRUCTIONS OVERLEAF


DC (ST/CGW) 206610

*9342856614*

## 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 80.**

**The marks for each question are shown in brackets [ ].**

**Quality of extended response will be assessed in questions marked with an asterisk (*).**

## ADVICE

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

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**Answer ALL the questions.**

**1 FIG. 1.1 shows three views of a walkie-talkie. A walkie-talkie is a hand-held portable two-way radio.**

**FIG. 1.1**
**(not to scale)**

**(a) Identify TWO examples of anthropometric data that could have been used in the design development of the walkie-talkie shown in FIG. 1.1.**

**1** _____

_____

**2** _____

_____

**[2]**

**(b) (i) State TWO ergonomic factors that would need to be considered during the design development of the walkie-talkie shown in FIG. 1.1.**

**Justify EACH of your responses.**

**1** _____

_____

_____

_____

**2** _____

_____

_____

_____

**[4]**

(ii) **Using ONE of the ergonomic factors you have identified in PART (b)(i), describe how the designer could test the effectiveness of this ergonomic factor during the iterative design process.**

_____

_____

_____

_____ **[2]**

(c) **Identify ONE smart or modern material that could be used in the design of the walkie-talkie shown in FIG. 1.1.**

**Justify how this smart or modern material would improve the design.**

_____

_____

_____

_____ **[2]**

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**(d) FIG. 1.2 opposite shows a line graph of the walkie-talkie sales over a year.**

**(i) Using information from FIG. 1.2, identify and explain the stages of the product's lifecycle from January 2019 to August 2019.**

_____

_____

_____

_____

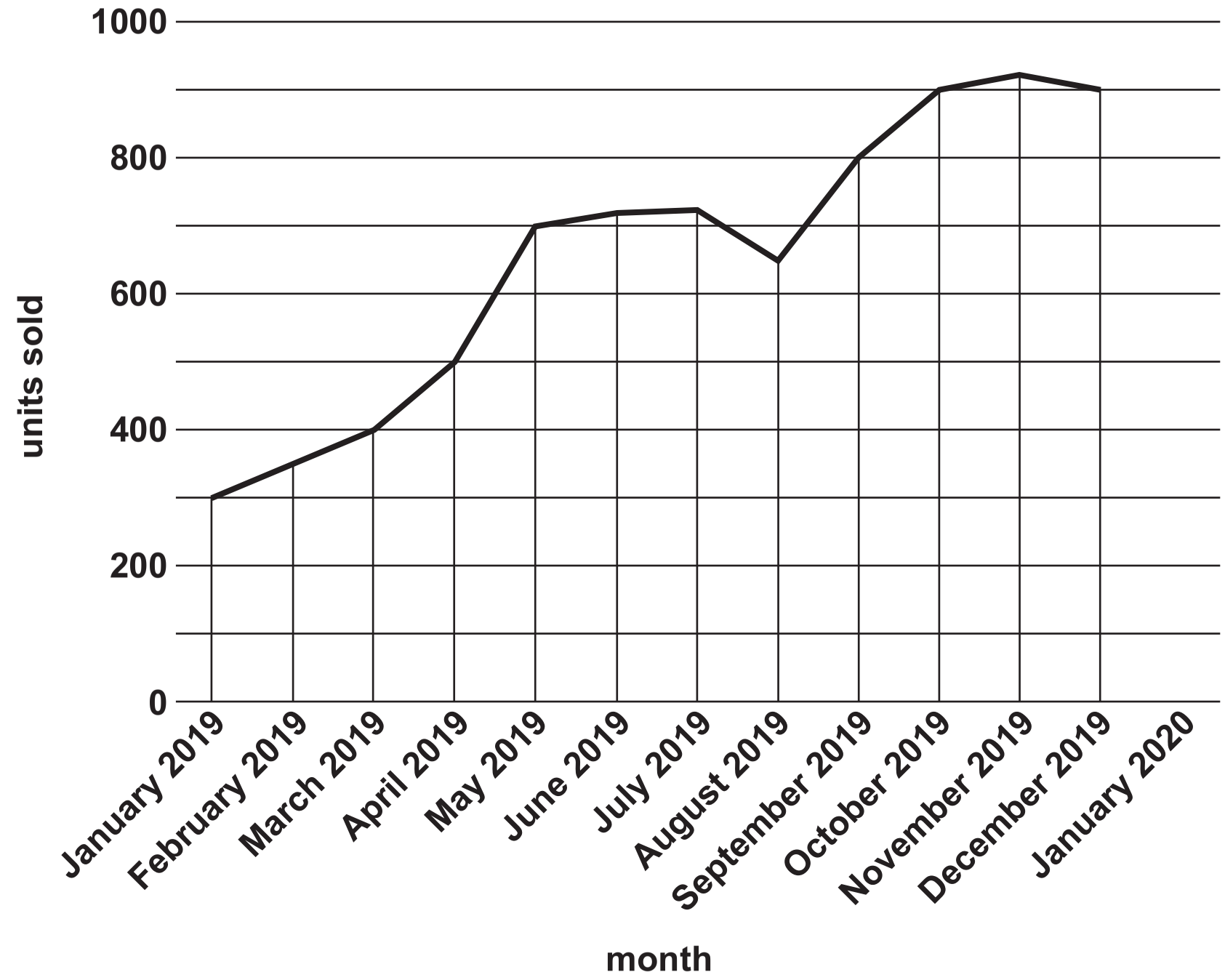
_____

_____

_____

_____ **[4]**

FIG. 1.2


1000
800
600
400
200
0
units sold
January 2019
February 2019
March 2019
April 2019
May 2019
June 2019
July 2019
August 2019
September 2019
October 2019
November 2019
December 2019
January 2020
month

**(ii) State TWO possible reasons for the change in the number of units sold from August 2019 to October 2019 as shown in FIG. 1.2.**

**1** _____

_____

**2** _____

_____

**[2]**

**(iii) The number of units sold in January 2020 decreased by 7% from the number of units sold in December 2019.**

**Using information from FIG. 1.2, calculate the total number of units sold in January 2020. [1]**

**Units sold in January 2020** _____

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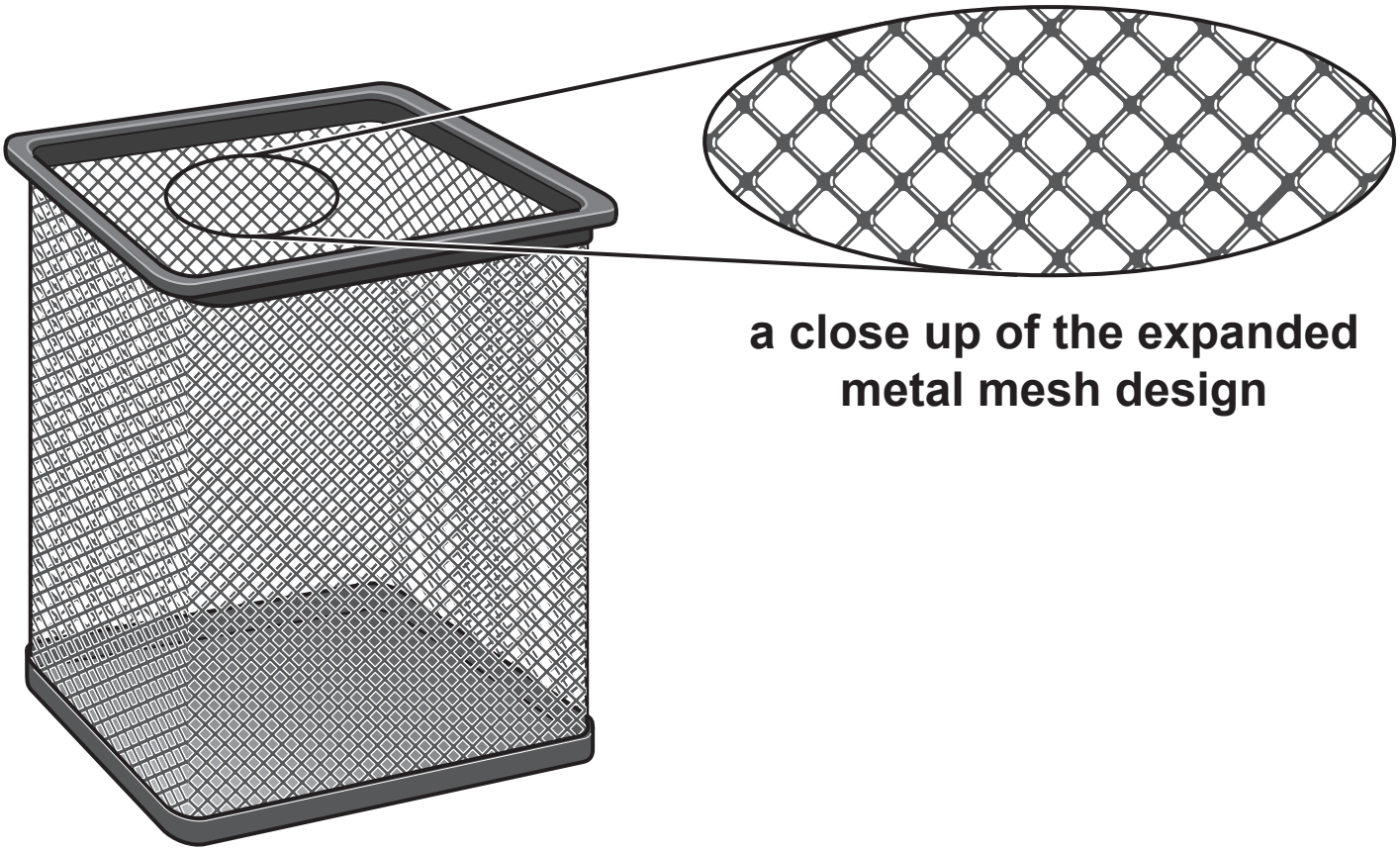
**(e) The designer of the walkie-talkie would have undertaken primary and secondary research as part of the iterative design process.**

**Discuss the importance of designers interpreting their own market research data and information from specialist websites and publications to inform their design decisions.**

**Refer to specific examples in your response. [8]**

**2 FIG. 2.1 shows a waste paper basket where the sides are manufactured from expanded metal mesh.**

**FIG. 2.1**



**a close up of the expanded metal mesh design**

**(a) Identify TWO advantages of using expanded metal mesh rather than solid sheet for the waste paper basket shown in FIG. 2.1.**

**1** _____

_____

**2** _____

_____

**[2]**

**(b) Explain how the design of the waste paper basket ensures structural integrity.**

_____

_____

_____

_____

_____

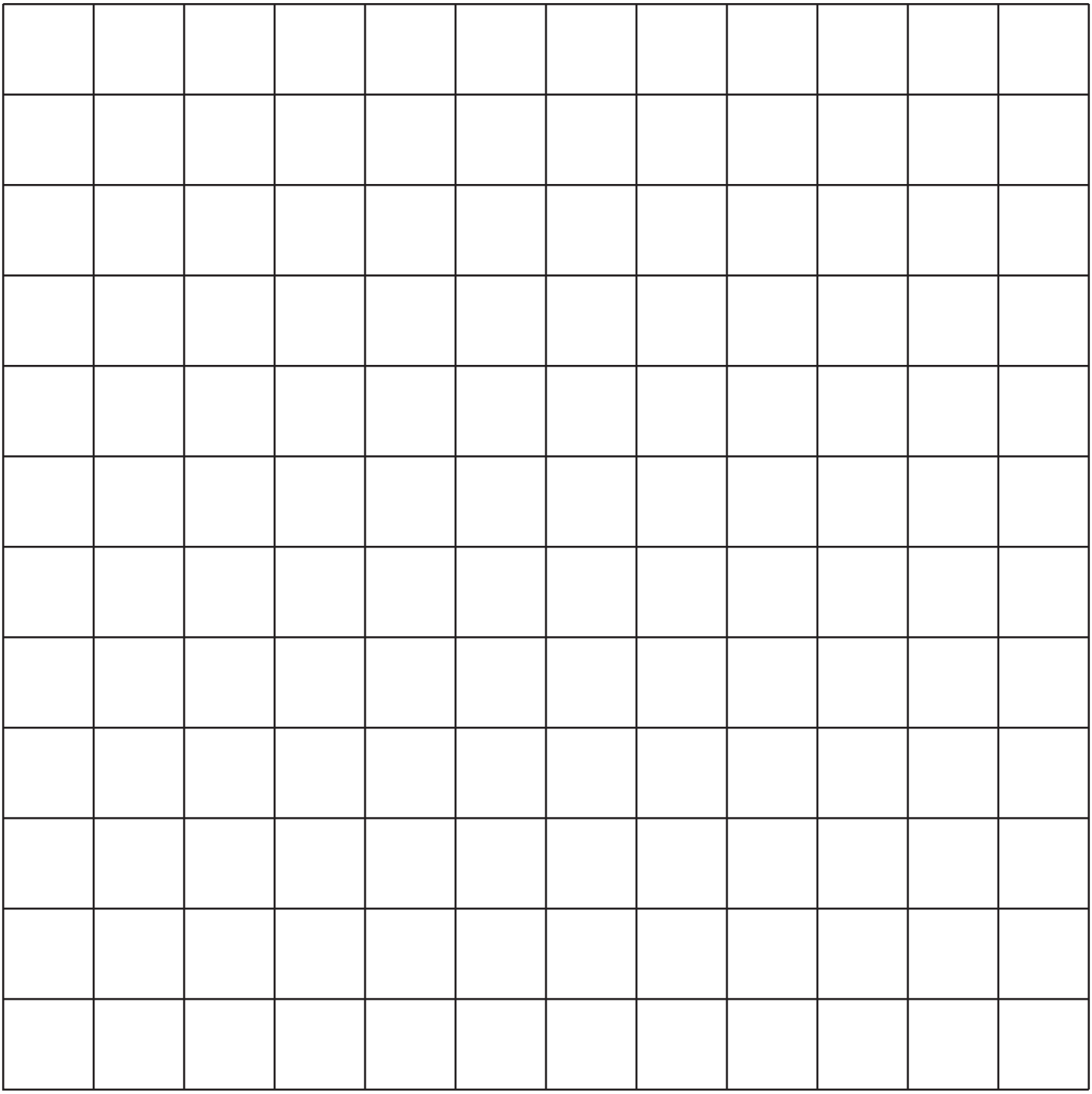
_____ **[3]**

(c) **The designer conducted market research into the colours of waste paper baskets that consumers may want in their office. 1500 people were asked their preferred colour.**

| Colour | Percentage of people (%) |
|---|---|
| Black | 39 |
| Silver | 20 |
| Red | 3 |
| Green | 7 |
| White | 31 |

**Space for working:**

**On the grid opposite, draw a bar chart to show the number of people who wanted each colour. Label the TWO axes. [3]**



**(d) FIG. 2.2 on the next page shows an outline drawing of the expanded metal meshed sides of the waste paper basket. The shape of the waste paper basket is a prism and the four corners of the waste paper basket are quarter-circles of external radius 10 mm.**

**(i) Using the information in FIG. 2.2, calculate the external surface area of expanded metal mesh that would form the sides of the waste paper basket. Give your answer in $cm^2$ to the nearest whole number. Show your working. [3]**

**External surface area _____ $cm^2$**

FIG. 2.2
(not to scale)

**(ii) The expanded metal mesh is supplied in a roll 0.9 metres wide.**

**Calculate the minimum length of expanded metal mesh that would be required to make 360 waste paper baskets. Give your answer in metres to 1 decimal place. Show your working.**

**Assume the manufacturer will cut the roll of expanded metal mesh to reduce any waste. [3]**

**Minimum length _____m**

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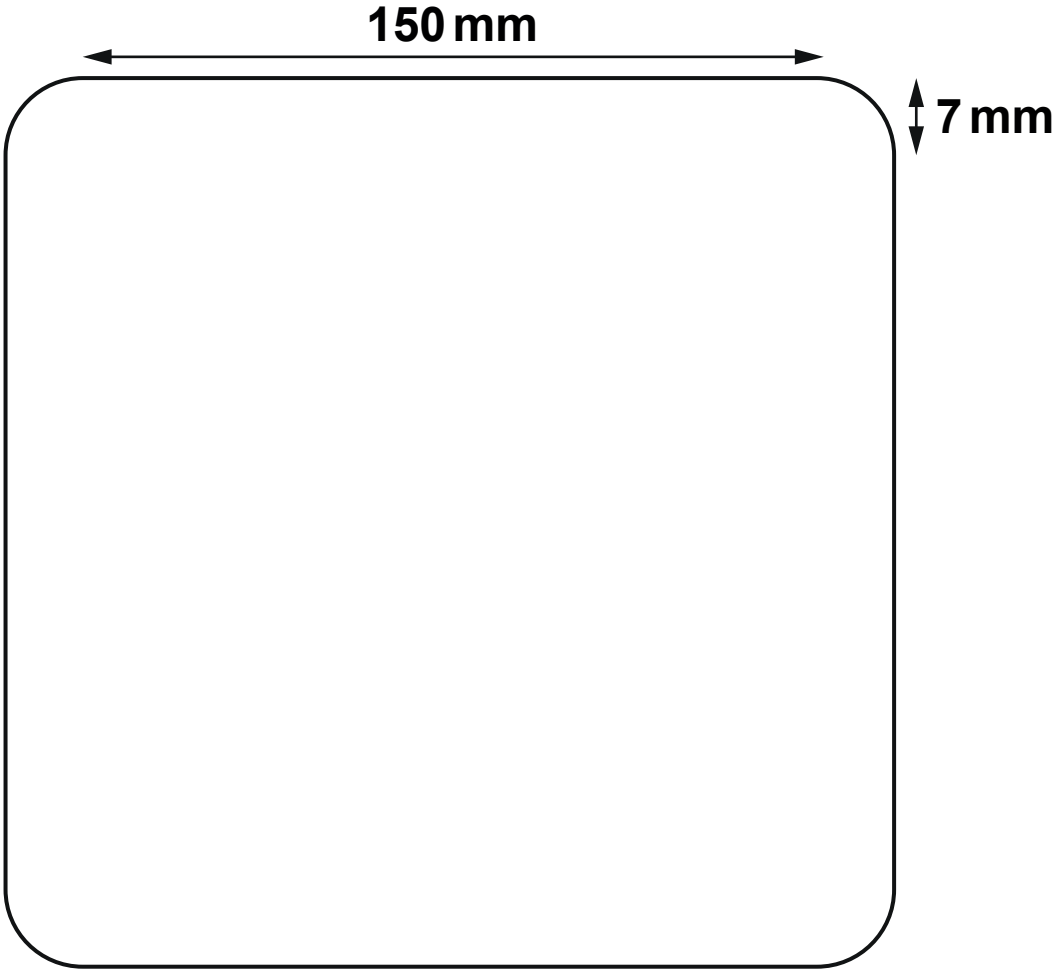
(iii) **The outline sketch below shows the internal dimensions of the waste paper basket. This takes account of the expanded metal mesh having a thickness of 3 mm.**

**Calculate the internal volume of the waste paper basket to the nearest half-litre. Show your working opposite. [5]**




**(not to scale)**

**Internal volume _____ litres**

**3 The global demand for energy is constantly rising. Fossil fuels account for the majority of energy consumption.**

**(a) Explain THREE problems with the widespread use of fossil fuels.**

**1** _____

_____

_____

_____

**2** _____

_____

_____

_____

**3** _____

_____

_____

_____

**[6]**

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**(b)* Discuss the implications of increasing the use of alternative renewable energy sources.**

**Refer to specific examples in your response. [8]**

4 **Modern tennis racket frames are commonly manufactured from an aluminium alloy or composite material.**

**The following image shows the front and side views of a tennis racket.**


**front view** **side view**

(a) **Compare the performance of a tennis racket frame made from an aluminium alloy with the performance of a tennis racket frame made from a composite material.**

_____

_____

_____

_____ **[2]**

**(b) Use annotated sketches and/or notes to show how the frame of a tennis racket would be manufactured as a batch of 200 from a COMPOSITE material.**

**Identify any relevant materials, quality control checks and specialist tooling.**

**Your response must demonstrate the processes involved. [8]**

(c) **Identify a suitable finish for a tennis racket frame made from an aluminium alloy.**

**Justify your response.**

_____

_____

_____

_____ **[2]**

(d) **Explain TWO ways in which physical testing could be used to test the functional feasibility of a tennis racket before full-scale commercial manufacture.**

**1** _____

_____

_____

_____

**2** _____

_____

_____

_____

**[4]**

**(e) Modern manufacturing methods are rapidly changing with developments in ICT and digital technology.**

**Discuss the impact of ICT and digital technologies on the manufacturing industry.**

**Refer to specific examples in your response.**

**[6]**

**END OF QUESTION PAPER**

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