OCR
Oxford Cambridge and RSA

Wednesday 5 June 2024 – Afternoon

A Level in Design and Technology: Product Design

H406/01 Principles of Product Design

Time allowed: 1 hour 30 minutes

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

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 **80**.
- 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 hearing aid is a device that fits on a person's ear to make sounds clearer and louder.

There are different types of hearing aid and some can be programmed and controlled remotely.

Fig. 1.1 shows a basic hearing aid in use.

Fig. 1.2 shows a labelled photograph of a hearing aid.

Fig. 1.1

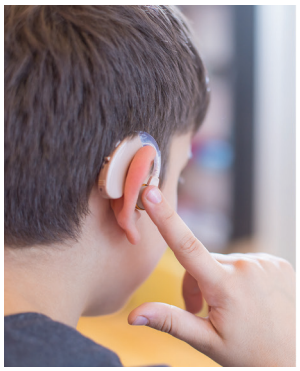
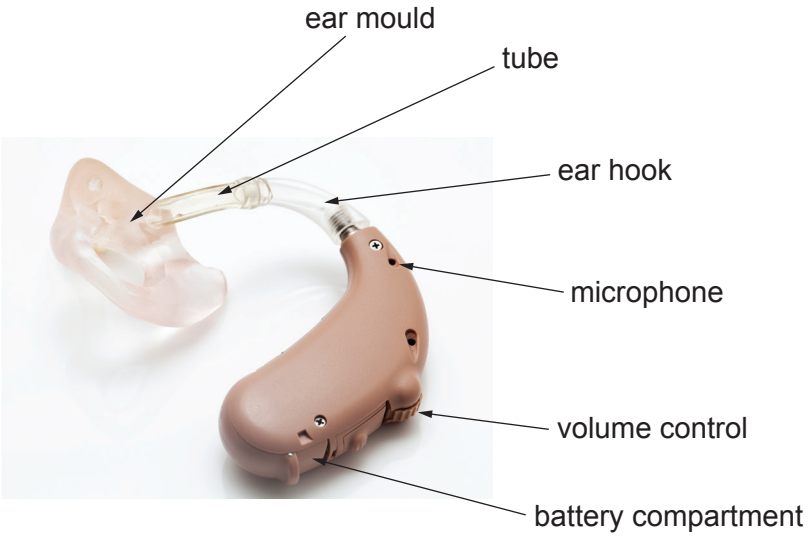


Fig. 1.2



(a) Identify a suitable specific material for the ear mould.

Justify your answer.

.....

.....

.....

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

(b) Explain why extrusion would be used to manufacture the tube.

.....

.....

.....

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

(c) Explain how **two** features of the hearing aid improve ease of use.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(d) Hearing aids are becoming increasingly more sophisticated.

(i) Discuss the influences new and emerging technologies could have on the design of the hearing aid.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

(ii) Identify **three** impacts on the user of incorporating new and emerging technologies into the design of the hearing aid.

Justify **each** of your answers.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

3 .....

.....

.....

..... **[6]**

(e) Explain how the hearing aid components could have been designed for disposal and end of product life.

.....

.....

.....

.....

.....

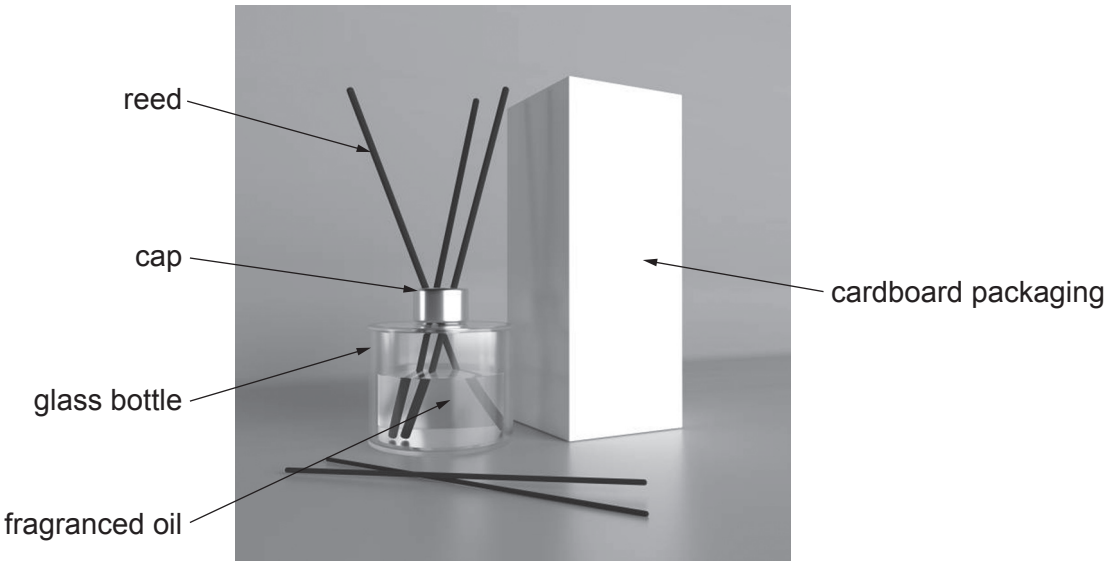
..... **[3]**

2 A reed diffuser is a product used in the home that allows a fragrance to fill a room.

Reeds are placed in a bottle containing fragranced oil. The fragrance is drawn to the top of the reed where it is released into the air.

Fig. 2.1 shows the product and cardboard packaging.

Fig. 2.1



(a) Identify and explain **two** reasons why sales of the reed diffuser may have increased in recent years.

1 .....

.....

.....

.....

2 .....

.....

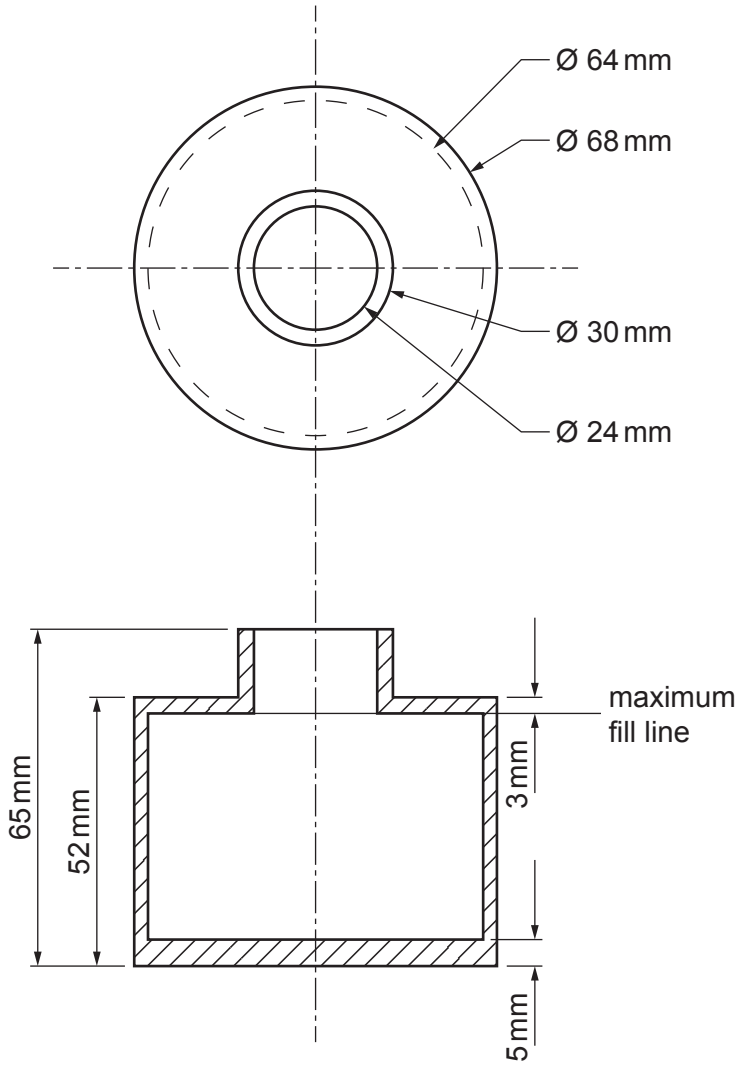
.....

.....

[4]

Fig. 2.2 shows a diagram of the cylindrical glass bottle.

Fig. 2.2



(not to scale)

(b)

(i) Use the information from **Fig. 2.2** to calculate the volume of the bottle up to the maximum fill line. Give your answer to the nearest cm^3 and show your working. **[4]**

Volume of bottle ..... cm^3

(ii) The oil costs £10 per litre.

For quantities over one litre the supplier will apply a 3% discount **to the total cost**.

Complete the table below to show the cost of the oil at different quantities. **[2]**

Quantity of Oil	Cost
1 litre	£10.00
2 litres	
3 litres	
4 litres	
5 litres	

(iii) The oil is sold in 25 ml increments.

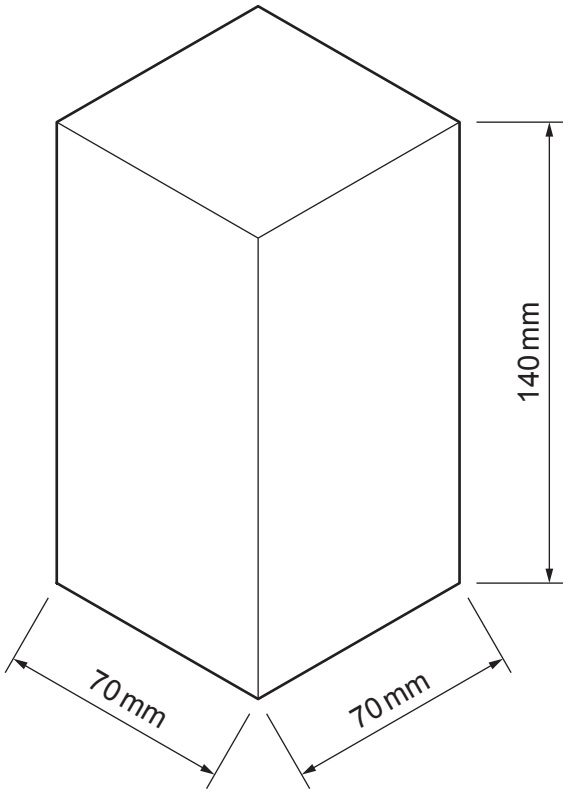
Use your answer from **part (b)(i)** to calculate how many increments of oil are needed to fill each bottle to the maximum fill line. Show your working. **[2]**

1 ml = 1 cm^3

Number of increments .....

Fig. 2.3 shows the cuboid cardboard packaging for the reed diffuser.

Fig. 2.3



(not to scale)

(c) The cuboid cardboard packaging has four sides, a top and a bottom.

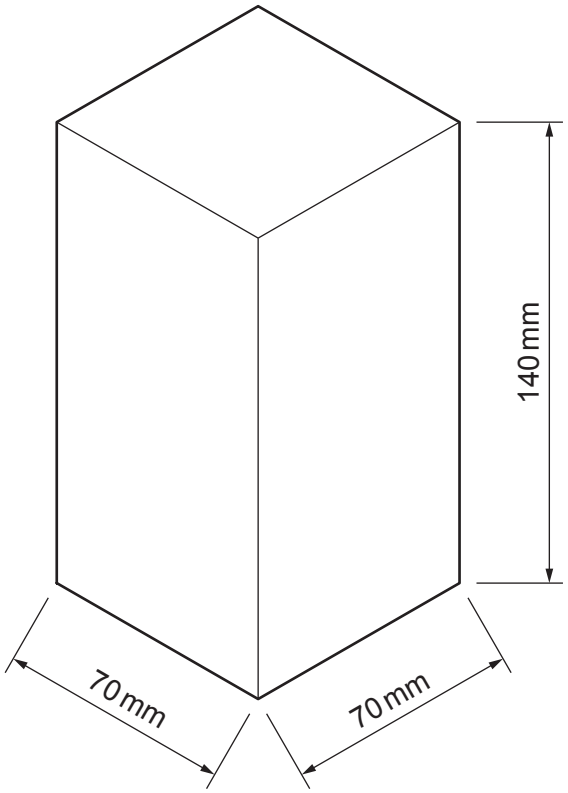
(i) Use the information from **Fig. 2.3** to draw a surface development (net) for the cuboid cardboard packaging.

Include glue tabs in your design. **[5]**

1 SQUARE represents 10 MM

This is a repeat drawing of **Fig. 2.3**.

Fig. 2.3



(not to scale)

(ii) Calculate the external surface area of the cuboid cardboard packaging excluding any glue tabs. Give your answer in cm^2 and show your working. **[2]**

External surface area ..... cm^2

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

3 Developments in design thinking and industrial manufacture have been influenced by a wide range of factors.

(a) Describe what is meant by the term Ethical Trade Initiative (ETI).

.....

.....

.....

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

(b) Describe what is meant by the term Fair Trade (FT).

.....

.....

.....

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

(c)* Discuss the challenges and issues faced by designers and manufacturers when supporting the Ethical Trade Initiative and Fair Trade.

Use specific examples of challenges and issues in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

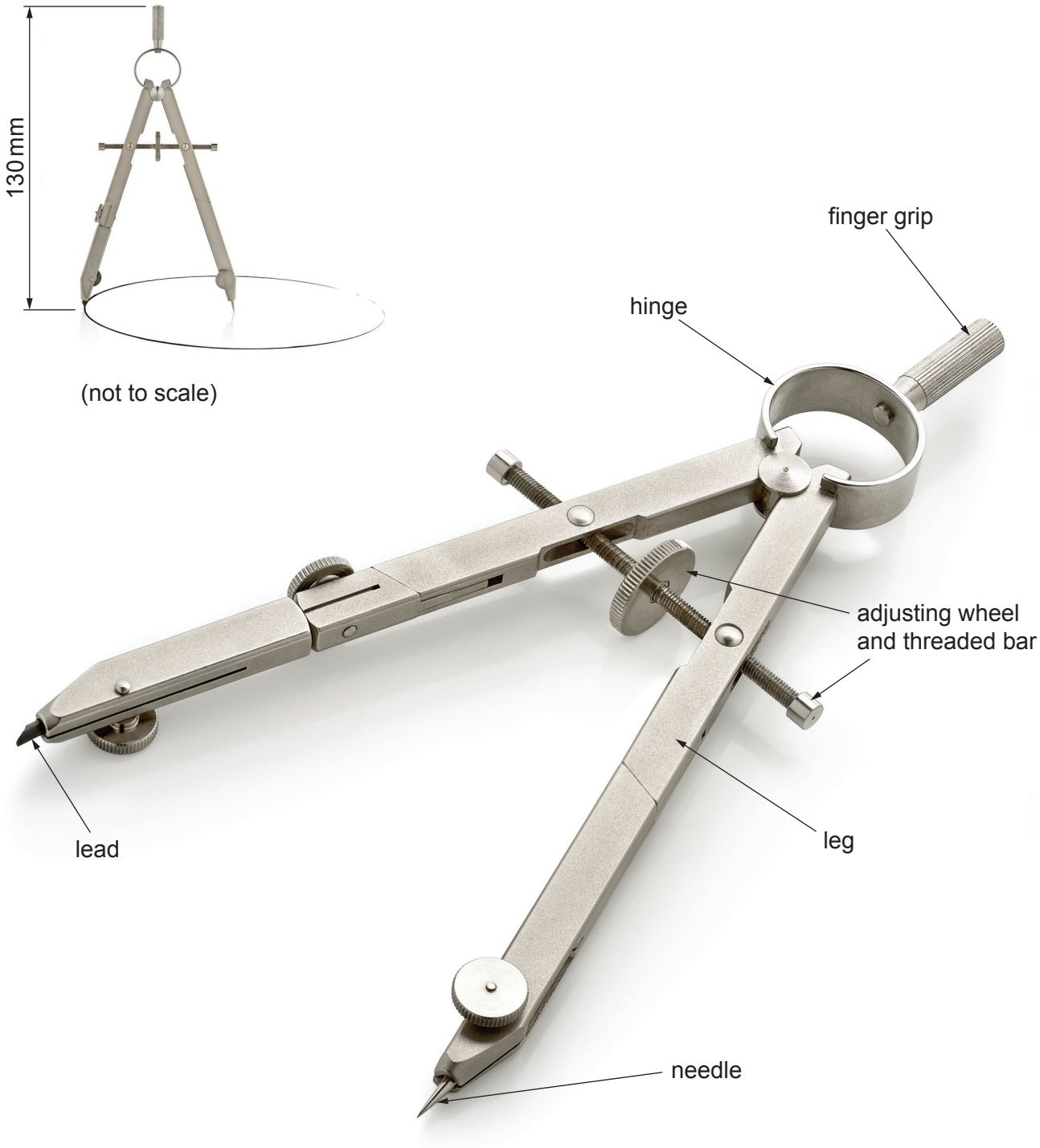
.....

.....

..... **[8]**

4 **Fig. 4.1** shows a drawing compass used for drawing circles.

Fig. 4.1



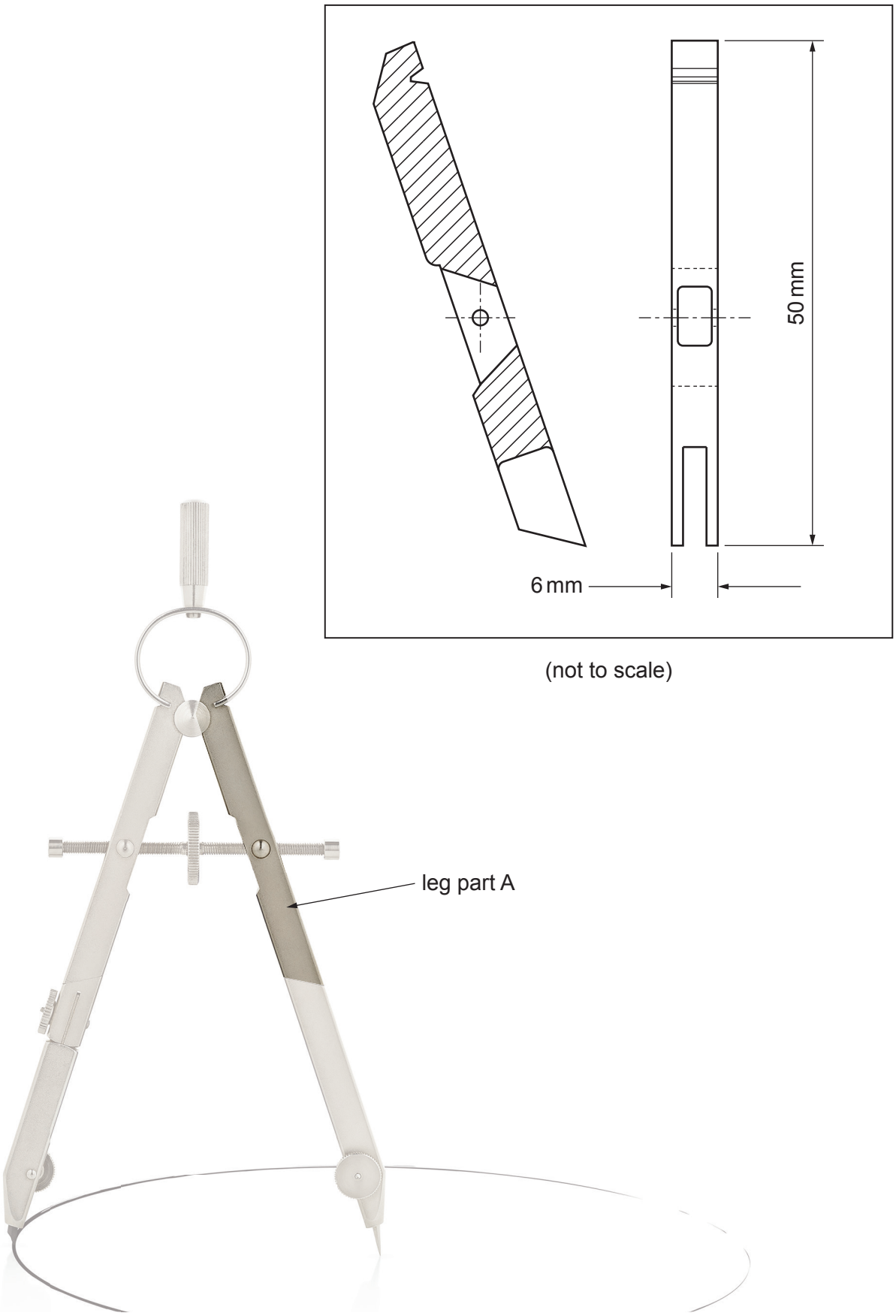
(a) A company is looking into whether the component parts of the compass could be manufactured in large quantities.

(i) Use annotated sketches and/or notes to show how a **single prototype** of the **adjusting wheel and threaded bar** could be manufactured in a workshop environment.

Identify any relevant tools, machinery and materials. **[5]**

Fig. 4.2 shows a drawing of the leg part A of the drawing compass highlighted below.

Fig. 4.2



(ii) Use annotated sketches and/or notes to show how the **leg part A** could be manufactured as a batch of 100 000 from metal.

Identify any relevant specialist tooling and quality control checks. **[8]**

(iii) The manufacturer carried out quality checks on each compass.

It noted that 20 in each batch of 100 000 are faulty.

Calculate the probability of a faulty compass. Give your answer as a % and show your working.

[2]

Probability ..... %

(b)

(i) Identify a suitable metal alloy for the needle of the drawing compass.

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

(ii) Identify **two** properties of the metal alloy you have identified in **part (b)(i)** that make it suitable for the needle of the drawing compass.

Justify **each** of your answers.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(iii) Describe how **one** of the raw materials for the metal alloy would be extracted from its origin.

.....

.....

.....

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

(iv) Describe **two** ways in which lean manufacturing could have impacted the production of the drawing compass.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE