OCR
Oxford Cambridge and RSA

A Level in Design and Technology: Product Design

H406/01 Principles of Product Design

Practice Paper – Set 1

Time allowed: 1 hour 30 minutes

You may use:
- a scientific calculator
- a ruler
- pencils/pens
- geometrical instruments

First name										
Last name										
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in the question marked with an asterisk (*).
- This document consists of **20** pages.

Answer **all** the questions.

1 **Fig. 1.1** shows two images of a wind up torch which can be charged by a user repeatedly pushing the trigger. The torch is designed to be given away free by companies as a promotional product. Companies can personalise the torch by printing their name on the surface.

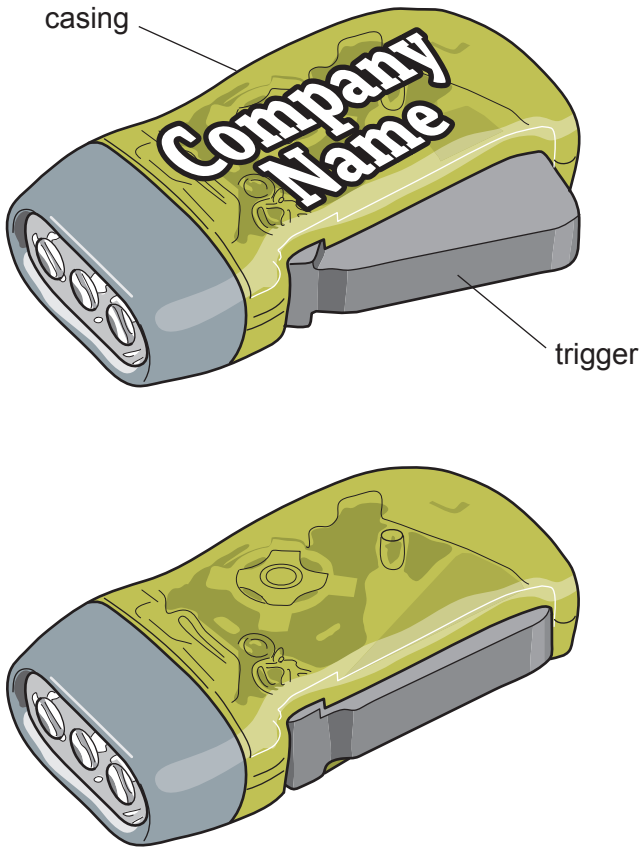

Fig. 1.1

(a) Name **one** thermopolymer that is suitable for the casing of the torch and explain why this would be used.

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

(b) **Fig. 1.2** shows prices for the torches.

Quantity purchased	**1–149**	**150–449**	**450–749**	**750–1124**	**1125–1499**	**1500+**
Price per torch	£2.32	£2.02	£1.95	£1.88	£1.82	£1.76

Fig. 1.2

A company needs to order a minimum of 730 torches, but no more than 800 torches.

Using the information in **Fig. 1.2**, calculate which quantity of torches within this range will offer the lowest total cost. Show your working.

Quantity ..... Total cost £ .....

[2]

(c) Ergonomics have been considered in the design of the torch.

(i) Explain **two** ways in which ergonomics have influenced the usability of the torch.

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[4]

(ii) Give **three** additional features that could be incorporated into the design of the torch to make it more ergonomic.

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[3]

(iii) Explain **two** implications to the company producing the torch of incorporating additional design features into the product.

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[4]

(d) Explain **two** benefits to companies of giving away free wind up torches as a promotional product.

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[4]

(e) The wind up torch is an example of a product that uses alternative technology.

Discuss the influences that may have led designers to use alternative technology in products.

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

2 **Fig. 2.1** shows a deck chair.
Fig. 2.2 shows a side and front view of the deck chair frame.

Fig. 2.1

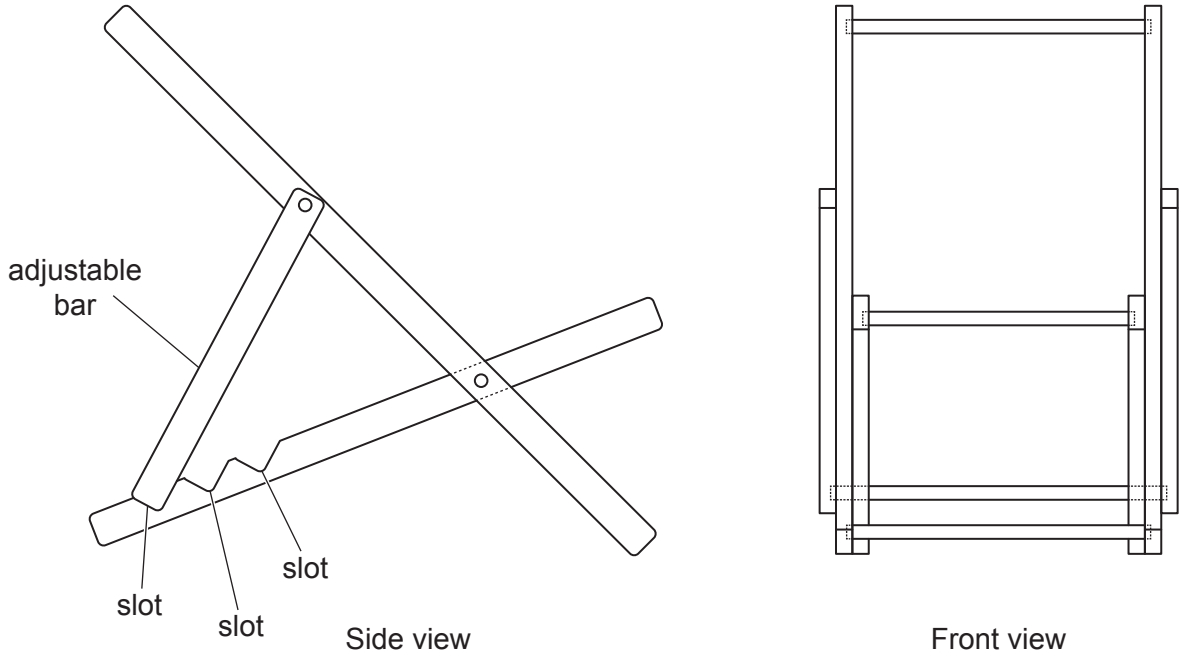

Fig. 2.2

(a) The height of the deck chair can be adjusted to different angles depending on which slot the bar is placed. The diagram in **Fig. 2.3** shows the deck chair in its most reclined position.

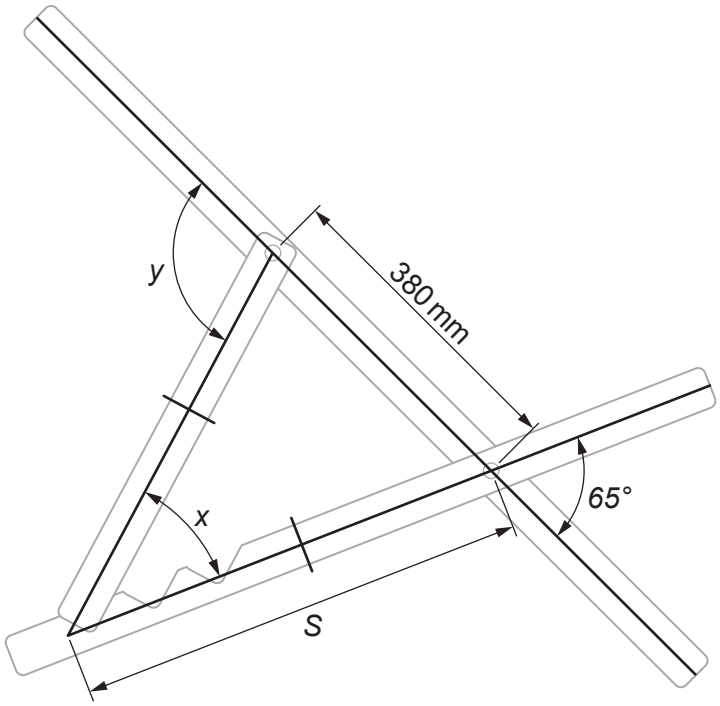

Fig. 2.3
(not to scale)

(i) Calculate angles *x* and *y*.

x ..... °

y ..... °

[2]

(ii) Calculate the length of side *S*. Show your working.

S .....mm

[4]

(b) The sides of the deck chair are made from 20 mm thick hardwood and joined with four lengths of dowel shown in **Fig. 2.4**. The dowel is inserted into holes that are 10 mm deep.

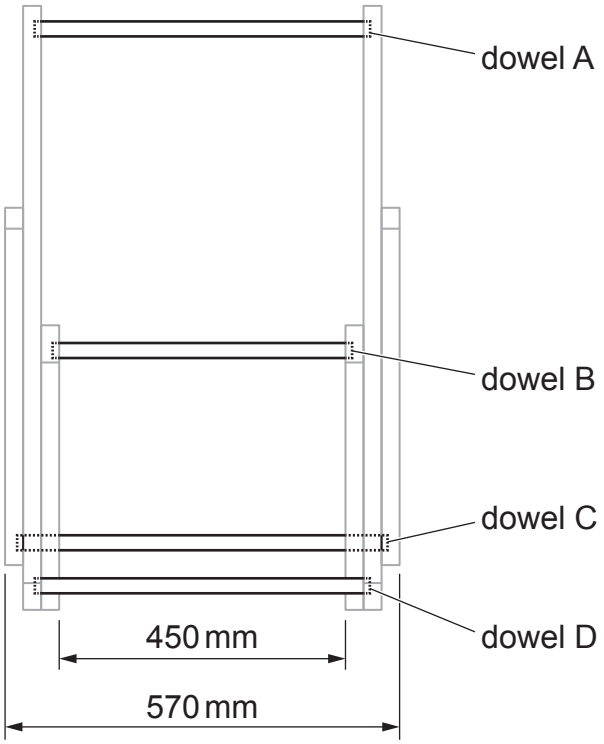

Fig. 2.4
(not to scale)

Using the information from **Fig. 2.4**, calculate the four dowel lengths needed.

Dowel A ..... mm

Dowel B ..... mm

Dowel C ..... mm

Dowel D ..... mm

[2]

(c) The deck chair width is 570 mm. When designing the deck chair, drawings are produced for manufacture. The drawings are to a scale of 1:6.

Calculate the width of the deck chair to be drawn.

Width ..... mm

[1]

(d) (i) State **one** reason why woven fabrics rather than non-woven fabrics would be used for the seat of the deck chair. Justify your response.

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

(ii) Each deck chair needs a length of 1800 mm of fabric to make the seat. The fabric can be purchased at £12.25 a metre.

Calculate the cost of the fabric for 40 deck chairs. Show your working.

£ .....

[2]

(iii) The length of the fabric is 1800 mm correct to the nearest 10 mm. The width of the fabric is 450 mm correct to the nearest 10 mm.

Calculate the upper bound of the area of the fabric. Show your working.

Upper bound of the area of the fabric ..... cm^2

[3]

(e) The finished deck chair was originally sold for £67.99. It was reduced by 25% in the end of season sale. Calculate the sale price of the deck chair in pounds and pence.

£ .....

[1]

3 There is a social pressure to reduce the use of 'single-use' plastic products and packaging.

(a)* Discuss the reasons for this and the impact it is having on manufacturers. Use examples of products you are familiar with to support your response.

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(b) Where plastic materials still need to be used in a product there will continue to be a negative environmental impact.

Explain **three** ways in which stakeholders can reduce the impact of plastics on the environment.

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[6]

4 **Fig. 4.1** shows a skateboard.
Fig. 4.2 shows details of the skateboard assembly.

Fig. 4.1

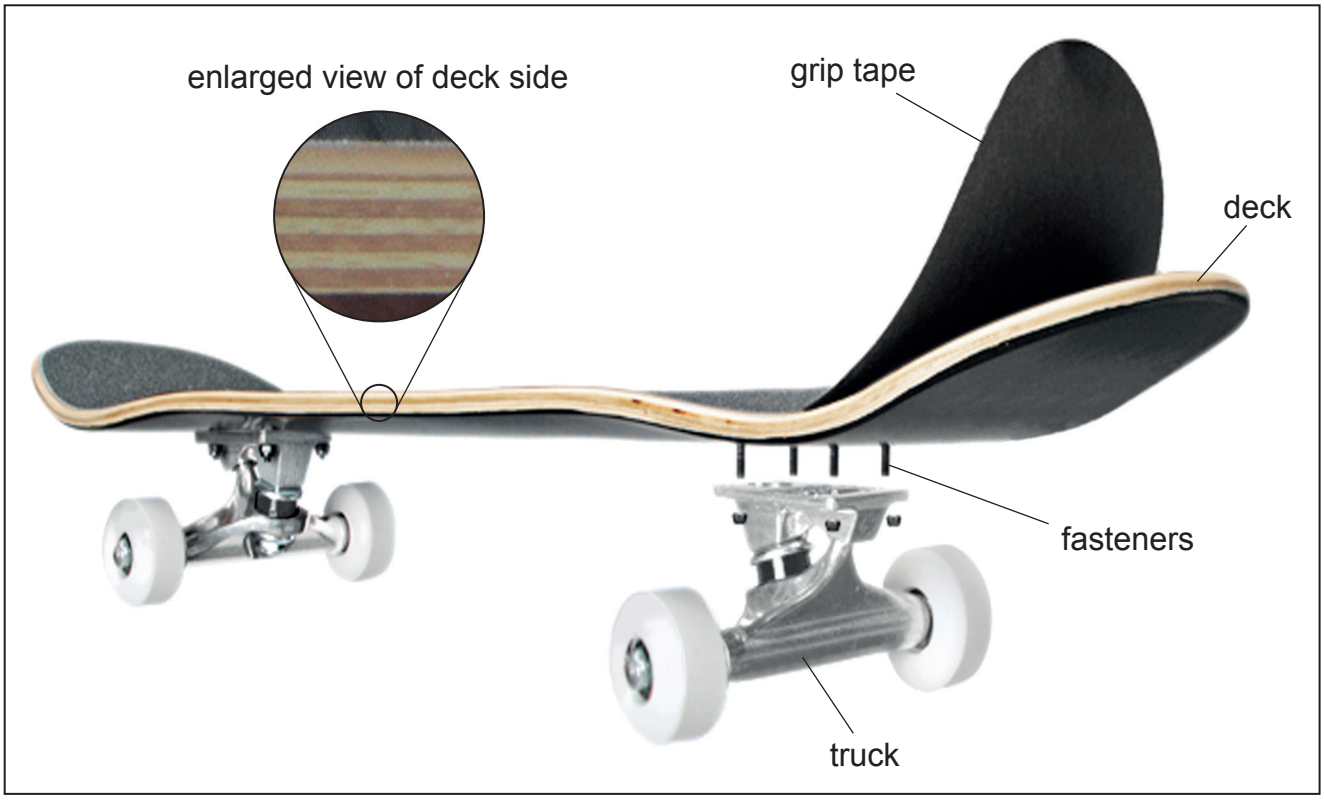

Fig. 4.2

(a) The deck of the skateboard shown in **Fig. 4.1** and **Fig. 4.2** forms the base that people stand on when in use.

Name **one** suitable hardwood for use in the manufacture of the deck shown in **Fig. 4.2** and explain why this would be used.

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(b) Explain, using sketches and/or notes, the process that would be used to manufacture the skateboard deck as shown in **Fig. 4.1** and **Fig. 4.2** as a batch of 2000.

Give details of any specialist tooling and quality control checks that would be used.

[8]

(c) The deck has holes drilled for the fasteners to fix the truck to the base as shown in **Fig. 4.2**. The holes are exactly the same diameter and in the same position on most standard skateboards.

(i) Explain how this design choice benefits **the manufacturer**.

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(ii) Explain how this design choice benefits **the consumer**.

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(d) Discuss the factors that need to be considered before distributing new products to market.

Use examples in your response.

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END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).