

A-level DESIGN AND TECHNOLOGY (PRODUCT DESIGN)

Paper 1 Technical Principles

Specimen 2016

Morning

Time allowed: 2 hours 30 minutes

Materials

For this paper you must have:

- Normal writing and drawing instruments
- a scientific calculator

Instructions

- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided/
- Do all rough work in this book. Cross through any work that you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 120.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number Candidate number Surname Forename(s)

Candidate signature _____

The photograph below shows a kitchen sink that has been manufactured from stainless steel.



1

Give **two** physical and **two** mechanical properties of the metal used for the kitchen sink. In each case, state why the property is suitable for this product.

[8 marks]

Physical
Property 1

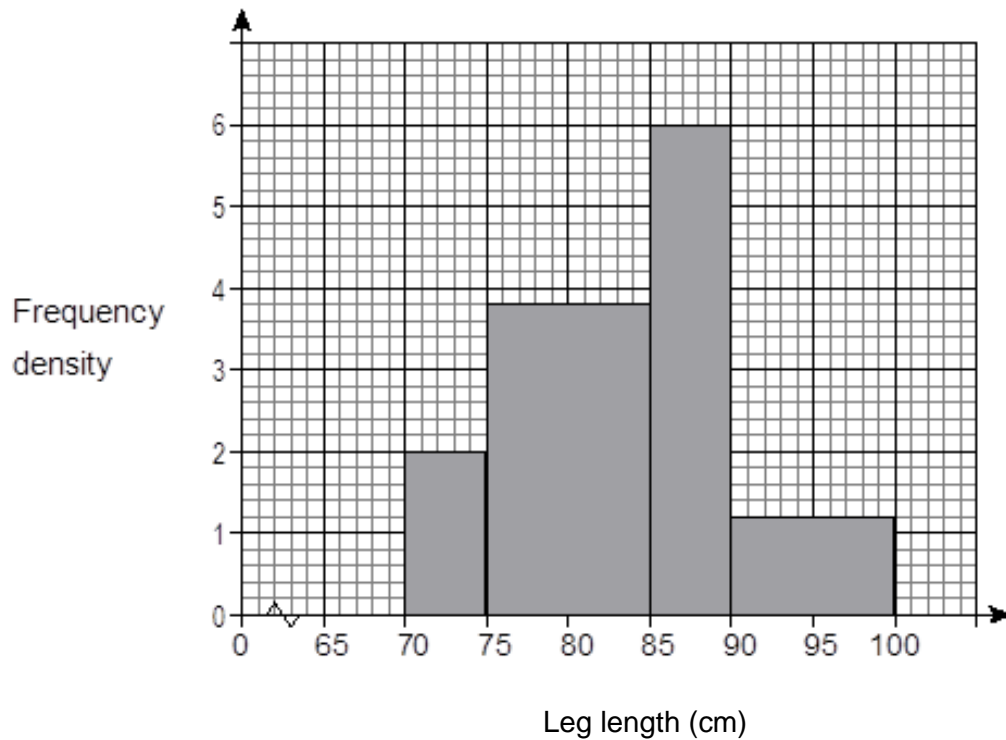
Physical
Property 2

Mechanical
Property 1

Mechanical
Property 2

2

A manufacturer of kitchen furniture wishes to design a range of kitchen high stools. The histogram below shows the leg length of a sample group of potential users.



Calculate the total number of users in the sample group and which of the four bars represents the greatest number of potential users

[4 marks]

3

Explain the meaning of the term 'fabrication process' and give an appropriate example.

[2 marks]

Figure 2



Manufactured from thermoplastic using polymer redistribution process

Figure 3



Manufactured from hardwood using fabrication process

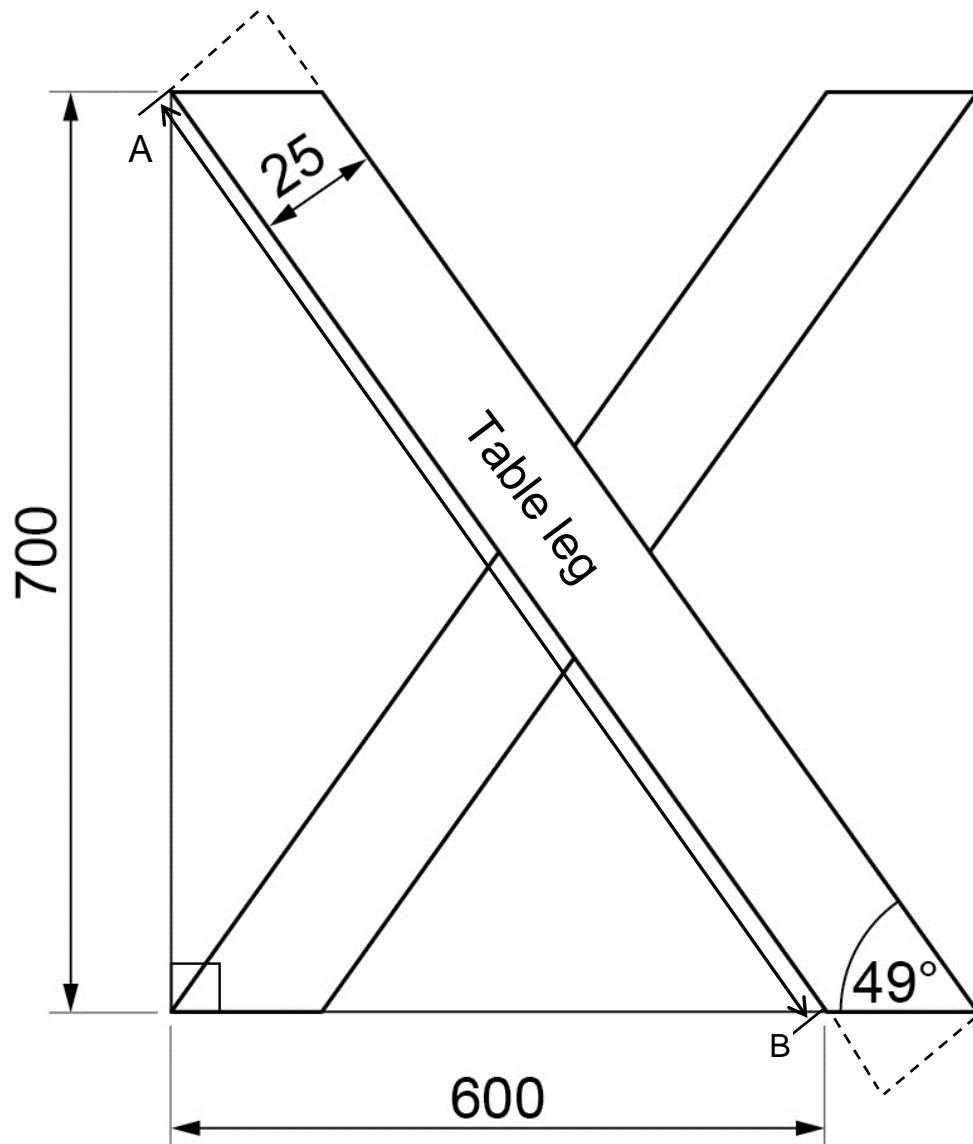
4

Compare the two types of chair shown in **Figure 2** and **Figure 3**. Evaluate their suitability for long term use in an outdoor environment.

[6 marks]

5

A dining table has been manufactured from lengths of wood. **Figure 4** shows a cross sectional view of two of the table legs.



All dimensions in millimetres

Figure 4
Cross sectional view of two of the table legs

Describe how the dining table in **Figure 4** could be manufactured using manual woodworking techniques.

In your answer, you should:

- determine the length AB shown in **Figure 4**
- calculate the minimum total length of a single piece of wood required to manufacture the four legs of the table, assuming no wastage from the cutting processes. Ignore blade thickness for the purpose of the calculation.
- refer to the tools and processes used in the different stages of manufacture.

[14 marks]

6

The photograph below shows a domestic bathroom shower. The shower tray is made from Acrylonitrile Butadiene Styrene (ABS) and has been manufactured using a vacuum forming process.



Name three key features of a successful vacuum forming mould.

[3 marks]

Feature 1

Feature 2

Feature 3

7

The shower tray has been manufactured using a vacuum forming process. Using notes and diagrams, describe how the shower tray has been manufactured.

[6 marks]

Space for diagrams

8 . 1

Figure 5 shows a CAD drawing of a lamp produced by a designer.



Figure 5

The aluminium lamp base is to be cast with the dimensions shown in Figure 6.

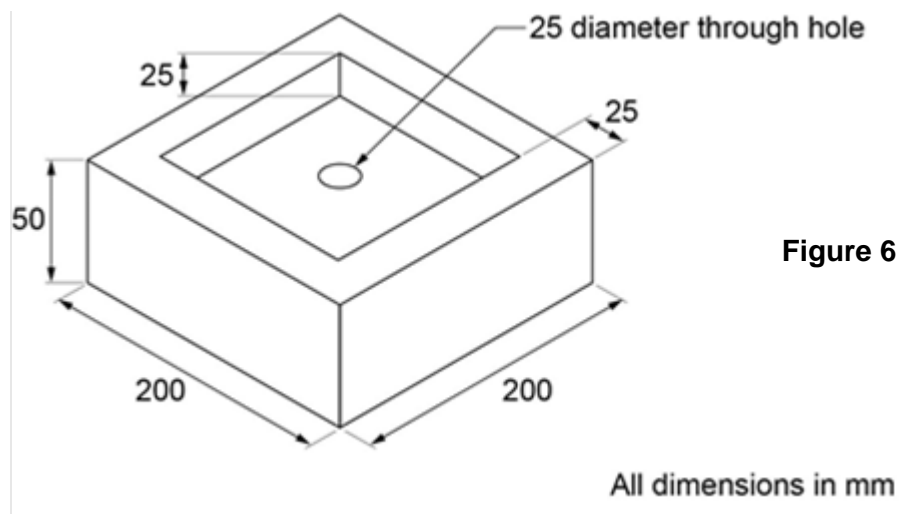


Figure 6

Aluminium costs £1580 per m³.

Calculate the material cost for 150 of the lamp bases described in **Figure 6**.

[4 marks]

8 . 2

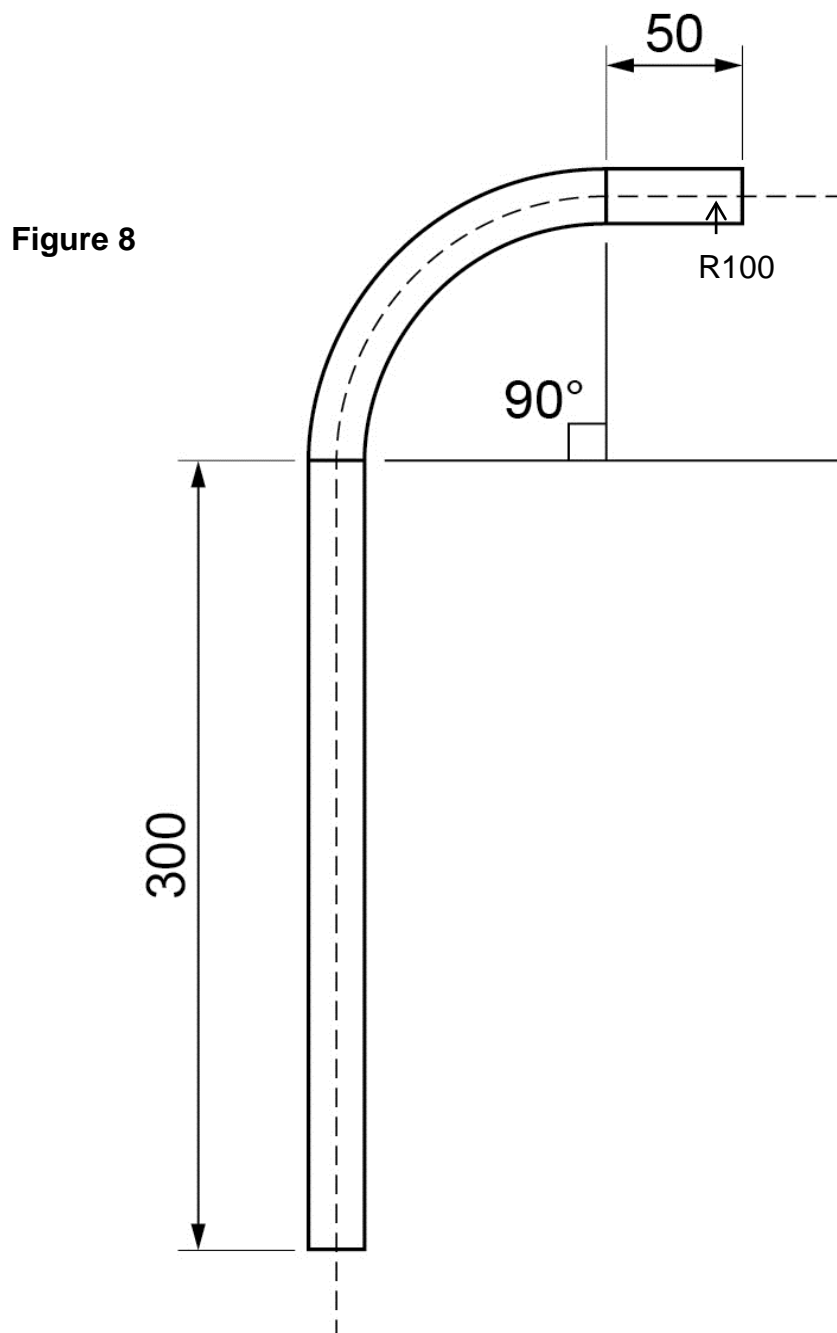
The stem of the lamp is bent from a single tube of mild steel with the dimensions shown in **Figure 7**.

Describe how the tube could be formed.

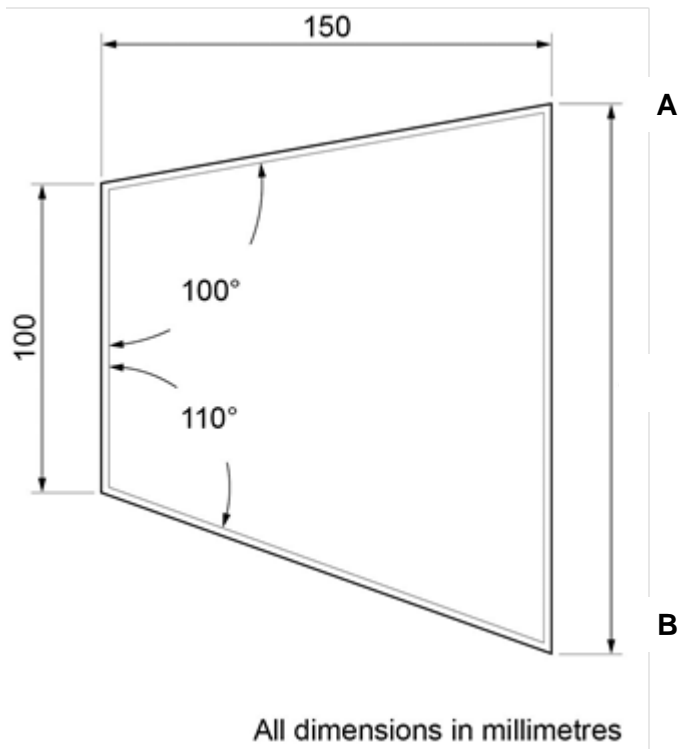
In your answer you should:

- explain the forming process and refer to the tools used, and
- calculate the length of tube required to create the stem. Give your answer to the nearest mm.

[6 marks]

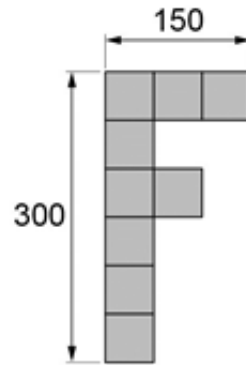


8 . 3

The lamp shade is formed to the profile shown in **Figure 8**.Calculate the width of the shade along line **AB**.**[3 marks]**

9

It takes 5 minutes to cut out a single acrylic copy of the shape shown in **Figure 9**. Cutting in plywood takes 15% longer. Calculate the laser cutting speed for each of these materials in metres per second.

[2 marks]**Figure 9**

All dimensions in mm

1 0

Shown below are two types of packaging used to contain soup.



Paper based soup carton



Metal soup can

Compare and evaluate the suitability of the two types of packaging used to contain soup. In your answer, you should make reference to:

- the materials used
- implications for the consumer.

[12 marks]

1 | 1

The paper carton soup company are producing 2000 units of prototype packaging. Select an appropriate printing process for this packaging and explain why it is suitable.

[6 marks]

The photograph below shows a remote control.



1 2

Explain the benefits of using CAD modelling in the development of a remote control.

[6 marks]

1 | 3

Describe three benefits of using rapid prototyping in the development of products like the remote control.

[3 marks]

1 | 4

Explain how designers consider anthropometrics and ergonomics in the development of remote controls like the one shown in **Figure 8**.

[9 marks]

1 5

The body of the racing car shown in is manufactured from a composite material.



Explain the meaning of the term 'composite material'.

[2 marks]

1 6

Name a suitable composite material for the body of the Formula 1 racing car shown in **Figure 9**.

[1 mark]

1	7
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The body of the racing car has been manufactured using a lay-up method. Name 6 stages in the manufacturing process.

[6 marks]

Stage 1 _____

Stage 2 _____

Stage 3 _____

Stage 4 _____

Stage 5 _____

Stage 6 _____

1 9

The photographs below show two baby feeding spoons. One spoon is made from metal, one spoon is made from a polymer with a smart material.



Metal spoon
Spoon A



Polymer with a smart material spoon
Spoon B

Explain why **Spoon B** may be more suitable than **Spoon A** for this application.

[5 marks]

END OF QUESTIONS