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DESIGN & TECHNOLOGY

0445/31

Paper 3 Resistant Materials

May/June 2020

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Section A: answer **all** questions.
- Section B: answer **one** question.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Answer in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].
- All dimensions are in millimetres.

This document has **20** pages. Blank pages are indicated.

Section A

Answer **all** questions in this section.

1 Give **two** pieces of information required when buying woodscrews.

1

2

[2]

2 A list of materials is given below.

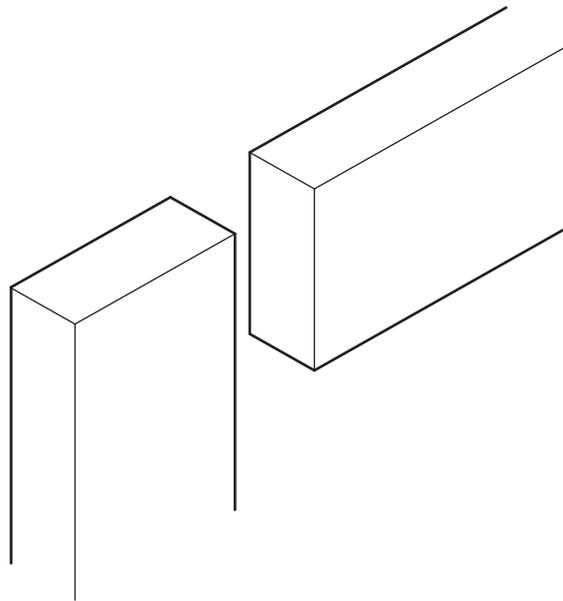
brass **CFRP** **copper** **polycarbonate** **stainless steel**

Select from the list **one** material that is:

(a) an alloy [1]

(b) a composite [1]

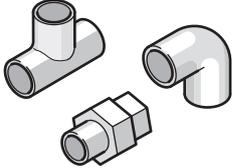
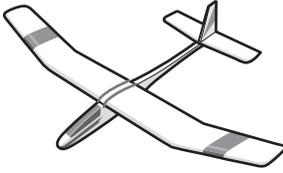
3 Complete the drawing below to show an exploded view of a corner halving joint.



[3]

4 Complete Table 4.1 by naming a suitable material for each product.

Table 4.1

Product	Suitable material
 plastic chair	
 metal water pipe fittings	
 wooden model glider	

[3]

- 5 Fig. 5.1 shows a coat hook for a child. The coat hook is made from 5 mm thick acrylic and will be batch produced.

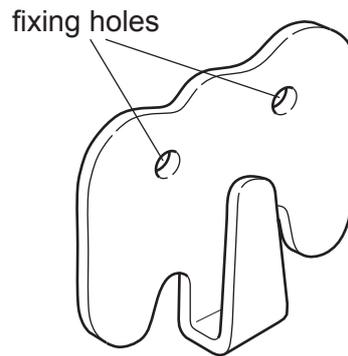


Fig. 5.1

Complete Table 5.1 by stating how each item could be used to speed up batch production of the coat hook.

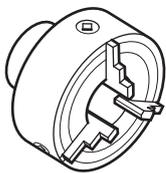
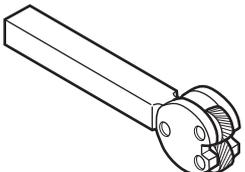
Table 5.1

Item	How each item is used to speed up production
Template	
Former	
Drilling jig	

[3]

- 6 Table 6.1 shows two items of equipment used with a centre lathe. Complete Table 6.1 by stating the name of each item of equipment.

Table 6.1

Item of equipment	Name
	
	

[2]

7 Fig. 7.1 shows the end of a mild steel strip marked out, ready to be shaped.

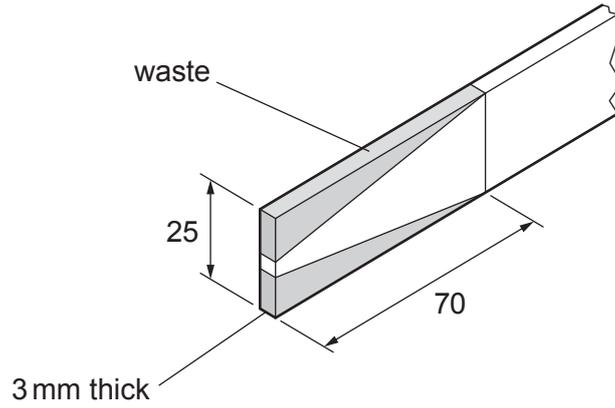


Fig. 7.1

Name the hand tool used to:

- (a) mark out the lines [1]
- (b) saw off the waste metal [1]
- (c) make the sawn edge flat and smooth [1]

8 Explain **one** advantage of using Computer Numerically Controlled (CNC) machines compared with manually operated machines for batch production.

.....

.....

..... [2]

- 9 Fig. 9.1 shows a box made from softwood.
The box will have a base made from 4 mm thick manufactured board.

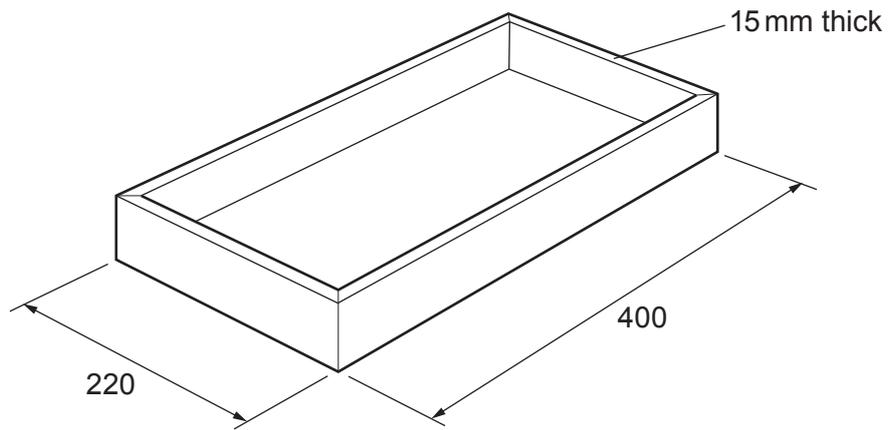


Fig. 9.1

Use sketches and notes to show how the base could be fitted **inside** the box so that the edges of the base are not seen.

[3]

10 Fig. 10.1 shows a plastic cup used for hot drinks.

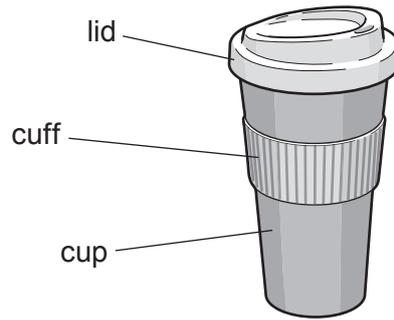


Fig. 10.1

Explain how the designer of the cup has considered the needs of the user.

.....

.....

..... [2]

Section B

Answer **one** question in this section.

11 Fig. 11.1 shows a pen and pencil holder.

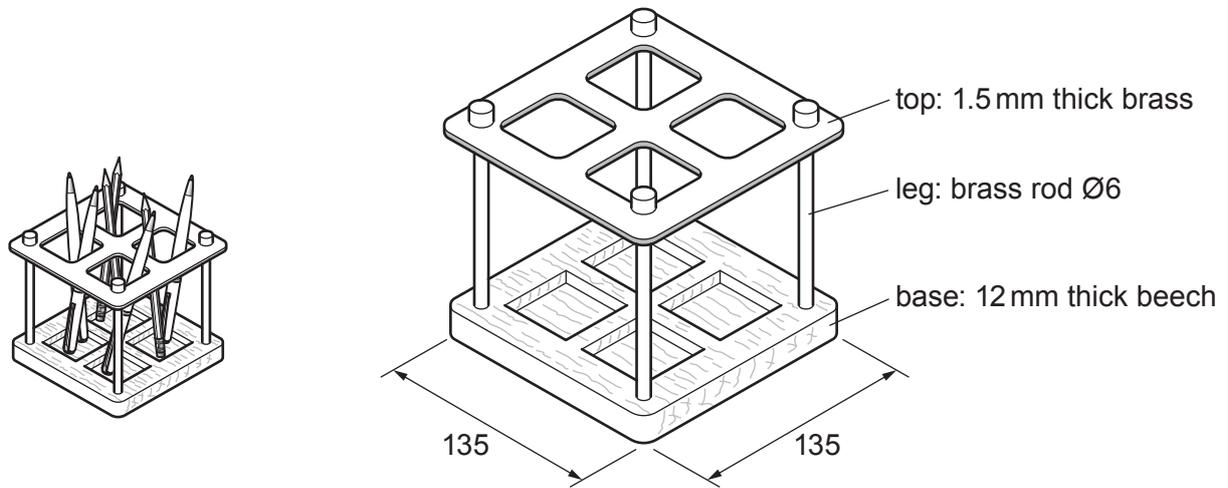


Fig. 11.1

(a) Fig. 11.2 shows the top part of the pen and pencil holder with the four shapes marked out.

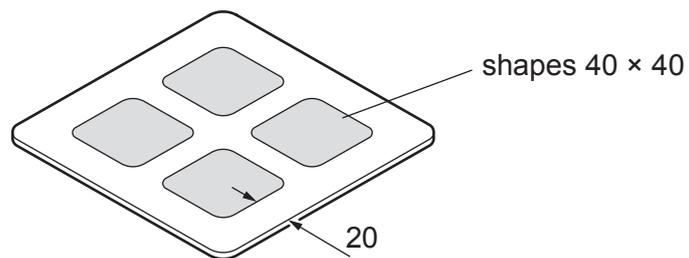


Fig. 11.2

Use sketches and notes to show how **one** of the shapes could be cut out and the edges made flat and smooth. Name all the tools and equipment used.

[4]

- (b) Fig. 11.3 shows how the legs are fitted to the top of the pen and pencil holder by means of screw threads.

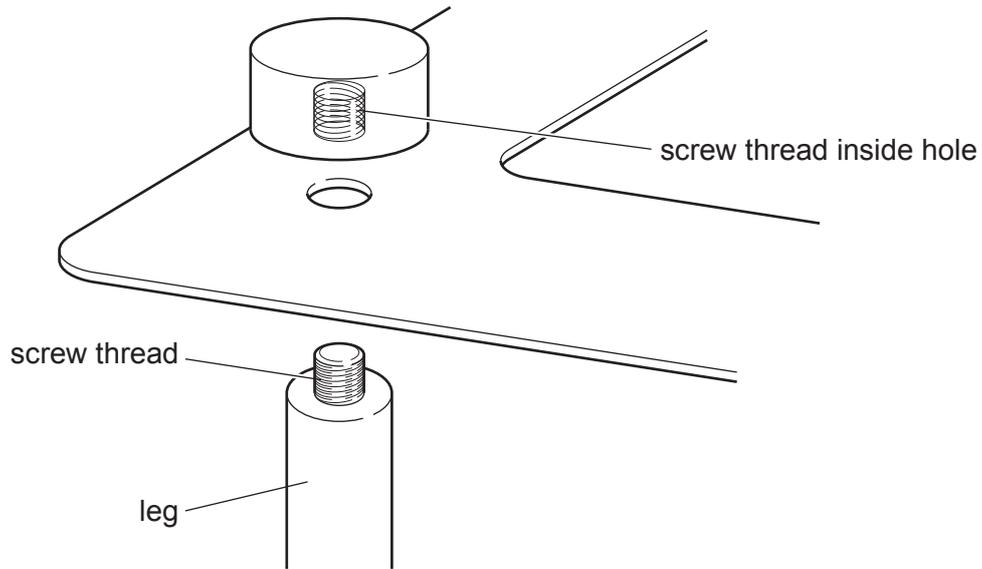


Fig. 11.3

- (i) Name the tool that could be used to cut the screw thread:
on the end of the leg

.....

inside the hole.

.....

[2]

- (ii) The screw thread could be replaced by a permanent method of fixing.

Circle from the list below a suitable permanent method of joining the legs to the top of the pen and pencil holder.

welding

brazing

soldering

[1]

- (c) Fig. 11.4 shows details of the shapes to be cut out of the base of the pen and pencil holder. A drill bit has been used to remove most of the waste wood in one of the shapes.

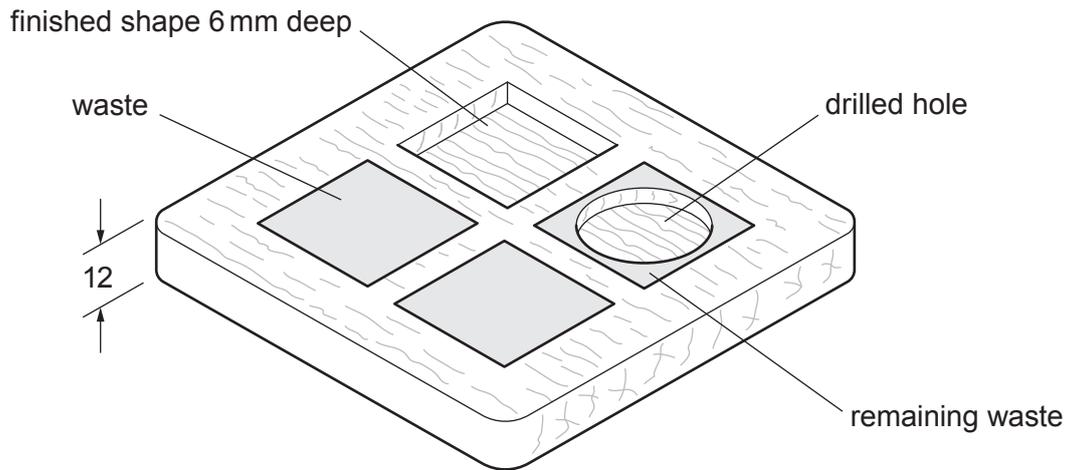


Fig. 11.4

- (i) Use sketches and notes to show how the remaining waste wood could be removed to produce an accurate finished shape.

[3]

- (ii) Give **one** benefit of using a close-grained hardwood for the base of the pen and pencil holder.

.....

..... [1]

- (d) Use sketches and notes to show a modification to the design of the pen and pencil holder shown in Fig. 11.1 that would make it easier to carry. Name all materials and constructions used.

[4]

- (e) Fig. 11.5 shows a pen and pencil holder made from acrylic.

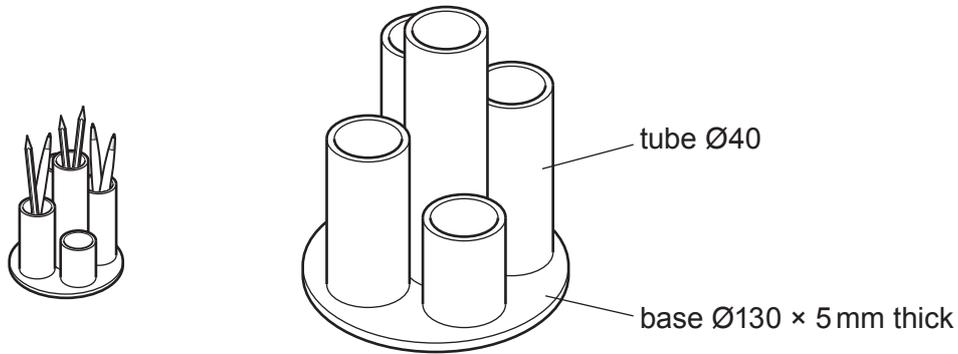


Fig. 11.5

- (i) Give **two** reasons why acrylic is a suitable material for the pen and pencil holder.

1

2

[2]

- (ii) Name the industrial process used to manufacture the acrylic tube.

..... [1]

- (f) Fig. 11.6 shows part of a length of acrylic tube from which the five tubes will be sawn to length.

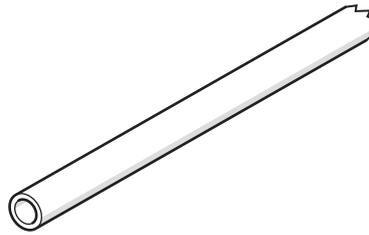


Fig. 11.6

- (i) Name a suitable saw that could be used to cut the acrylic tube to length.

..... [1]

- (ii) Use sketches and notes to show a design for a sawing jig.

The jig must:

- hold the tube securely
- enable **five** different lengths, 50, 80, 90, 100 and 120 mm, to be sawn accurately.

[4]

- (g) The tubes will be joined to the base using acrylic cement.

Acrylic cement gives off toxic fumes.

Describe **two** ways by which the danger from toxic fumes can be safely reduced.

1

2

[2]

12 Fig. 12.1 shows an incomplete design for a storage box made from wood.

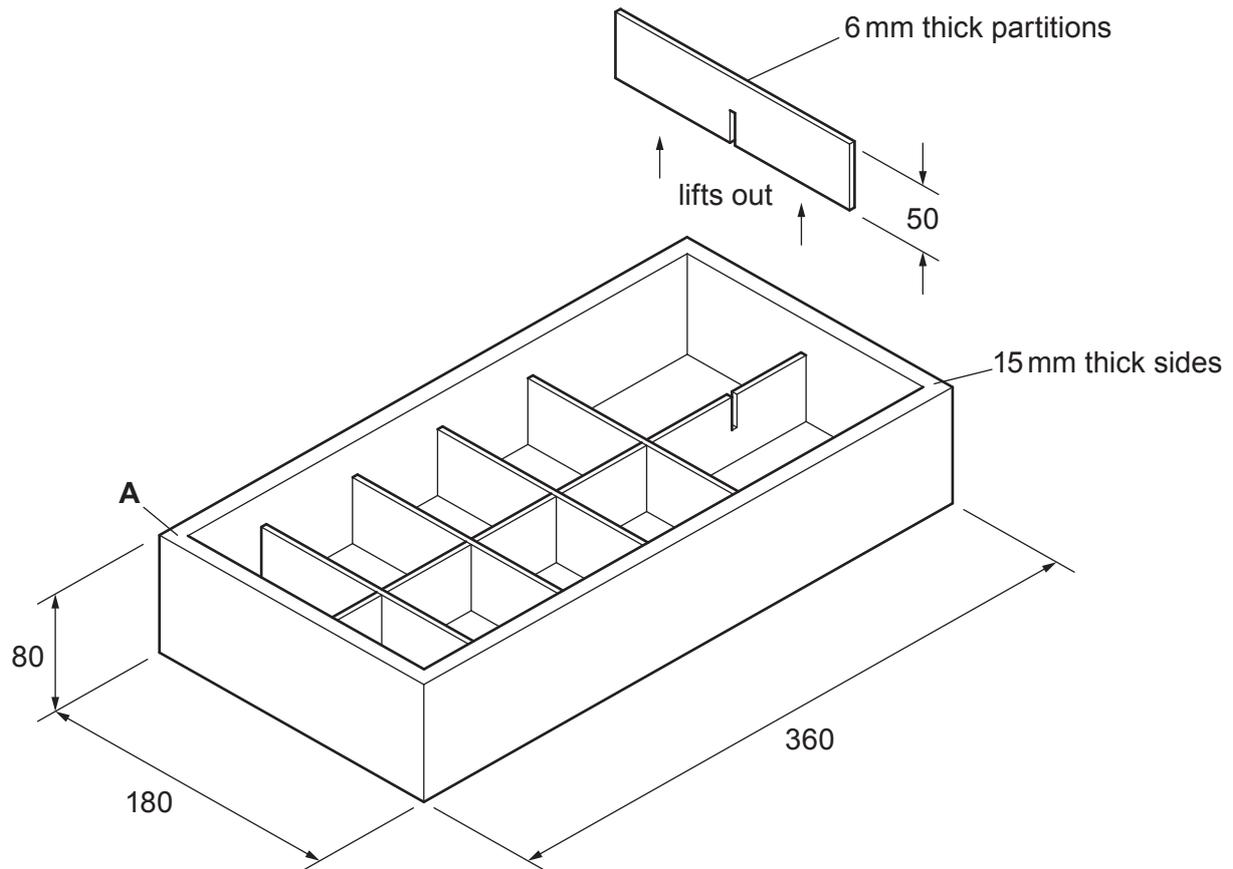


Fig. 12.1

(a) Complete Table 12.1 by adding the missing dimensions of the parts.

Table 12.1

Part	Number required	Length × Width × Thickness	Material
Long side	2	360 × 80 × 15	beech
Short side	2	180 × × 15	beech
Base	1	× 180 × 6	plywood
Long partition	1	× 50 × 6	plywood
Short partition	5	× 50 × 6	plywood

[4]

(b) Name and sketch a permanent joint that could be used at corner **A**.

Name of joint

[4]

(c) Fig. 12.2 shows a cross-halving joint used so that the partitions can fit together and be removed.

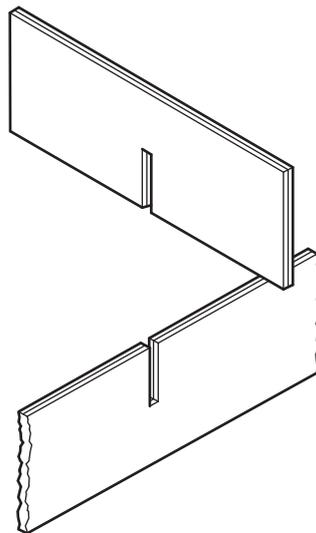


Fig. 12.2

(i) Name **two** different saws that could be used to cut out the cross-halving joint.

1

2

[2]

(ii) Give **two** advantages, other than cost, of making the partitions from plywood rather than beech.

1

2

[2]

- (d) Use sketches and notes to show a different method of keeping items separate inside a storage box.

[3]

- (e) To complete the design of the storage box in Fig. 12.1 modifications need to be made.

- (i) Use sketches and notes to show a design for a lid that could be fitted to the storage box. Include all details of materials, constructions and fittings used.

[5]

- (ii) Use sketches and notes to show a modification that would make it easier to carry the storage box. Include all details of materials, constructions and fittings used.

[3]

- (f) Fig. 12.3 shows a similar design for a storage box made from injection moulded plastic.

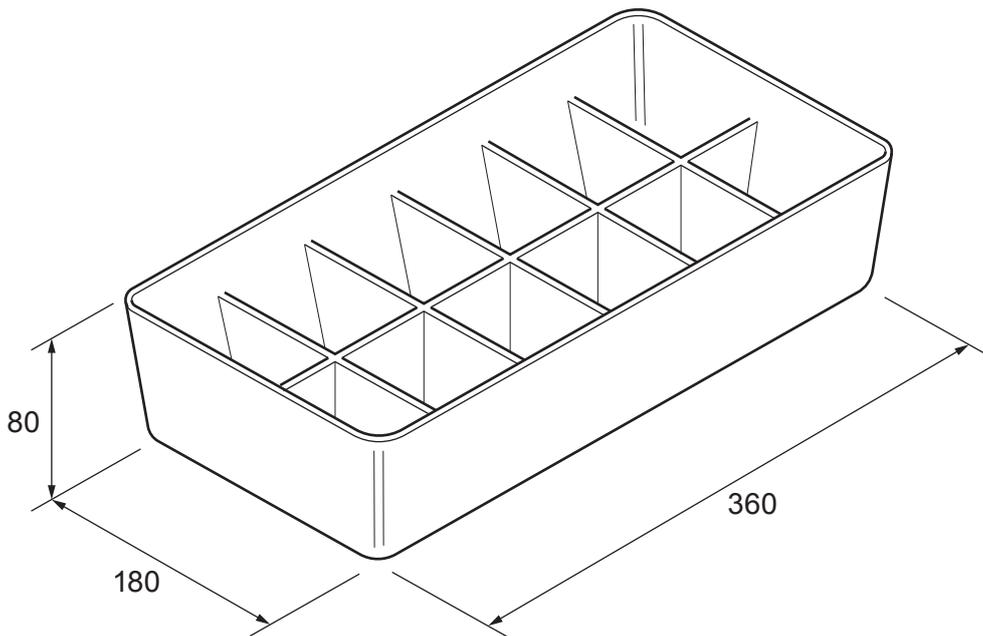


Fig. 12.3

Give **two** advantages of making the storage box from plastic rather than wood.

1

2

[2]

- 13 Fig. 13.1 shows wind chimes that will be batch produced in a school workshop. All the production methods require speed and accuracy.

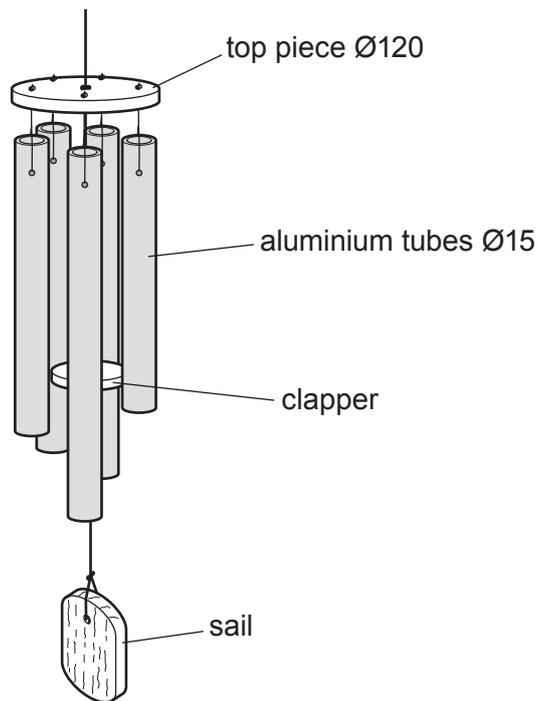


Fig. 13.1

- (a) Give **two** advantages of using a non-ferrous metal such as aluminium for the tubes rather than a ferrous metal.

1

2

[2]

- (b) (i) Use sketches and notes to show a design for an adjustable sawing jig that could be used to cut five different lengths of tube to the following sizes:
300, 280, 250, 240 and 220 mm.
Name the materials used to make the sawing jig.

[4]

- (ii) Describe how a centre lathe could be used to produce a flat and smooth finish to the sawn ends of the aluminium tubes.

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

(c) The aluminium tubes will have a lacquered finish.

- (i) Name an abrasive paper that could be used to prepare the surface of the aluminium tubes.

..... [1]

- (ii) Name a machine that could be used to produce a high quality finish on the aluminium tubes after abrasive paper has been used.

..... [1]

- (iii) State a method of applying lacquer quickly and evenly.

..... [1]

- (d) Fig. 13.2 shows a block of wood that will be used to make the top piece of the wind chimes. The shape of the top piece has been marked out and will be produced on a woodturning lathe.

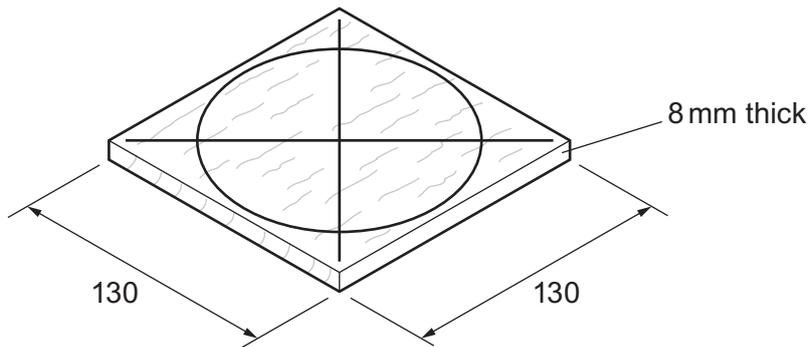


Fig. 13.2

- (i) Circle from the list below **two** methods of woodturning that could be used to produce the top piece of the wind chimes.

parallel between-centres taper faceplate centre

[2]

- (ii) Use sketches and notes to show a different method of producing the shape for the top piece of the wind chimes.

[3]

- (e) Describe **two** quality control checks that could be carried out at any stage during the batch production of the wind chimes.

1

.....

2

.....

[4]

- (f) The wind chimes will be suspended from a bracket.
Fig. 13.3 shows part of the wind chimes.

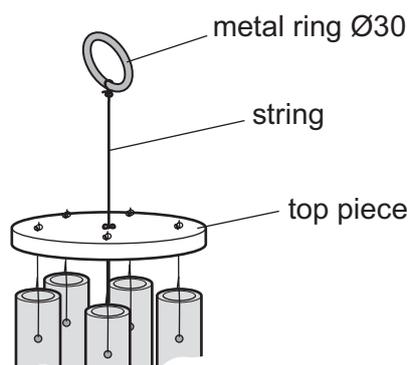


Fig. 13.3

Use sketches and notes to design a bracket from which the wind chimes could be suspended.

The bracket must:

- be able to be fixed to a wall
- hold the wind chimes securely.

Include details of all materials and constructions used.

[4]

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