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DESIGN & TECHNOLOGY

0445/32

Paper 3 Resistant Materials

May/June 2023

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.

Section A

Answer **all** questions in this section.

- 1 Fig. 1.1 shows a variety of television remote controls.



Fig. 1.1

State **three** specification points a designer would need to consider when designing a television remote control.

- 1
- 2
- 3

[3]

- 2 Fig. 2.1 shows a shaped piece of hardwood.

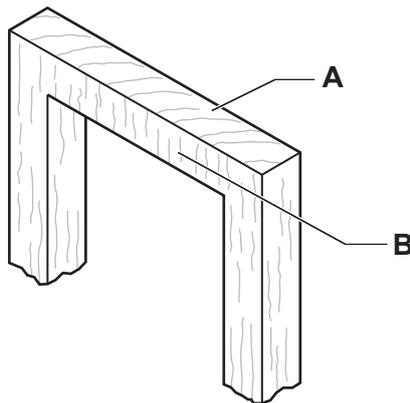


Fig. 2.1

State from the list below the correct name for the types of grain labelled at **A** and **B** in Fig. 2.1.

- cross short patterned straight end**

Grain **A**

Grain **B**

[2]

3 Fig. 3.1 shows a cross-sectional view of an injection moulding machine.

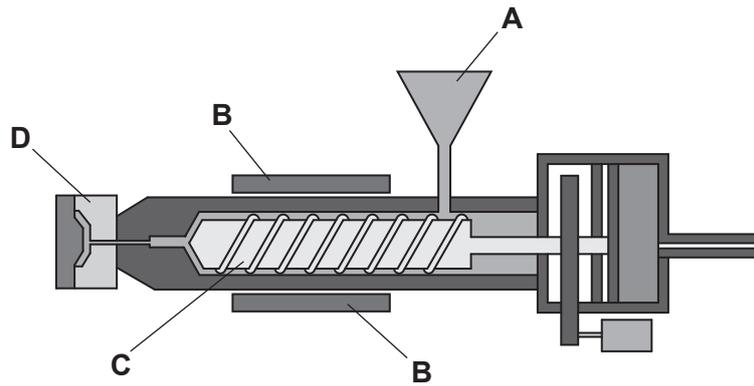


Fig. 3.1

Complete Table 3.1 by stating the name of the components B, C and D.

Table 3.1

Component	Name of component
A	Hopper
B	
C	
D	

[3]

4 Fig. 4.1 shows one part, the yoke, of a two-piece former that is used to produce the press formed moulding.

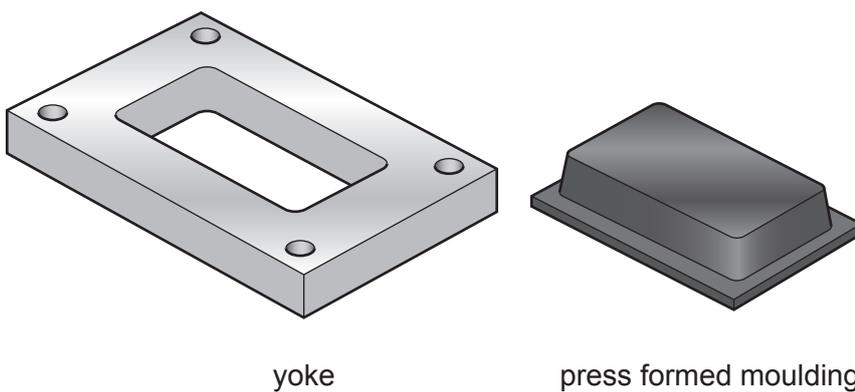


Fig. 4.1

Complete Fig. 4.1 by drawing the plug over which the yoke will fit to produce the press formed moulding.

[3]

- 5 Circle from the list below **one** metal that is a pure metal.

mild steel

brass

stainless steel

aluminium

[1]

- 6 Fig. 6.1 shows the back of a shelf unit and details of two keyhole plates that will be used when fitting the shelf unit to a wall.

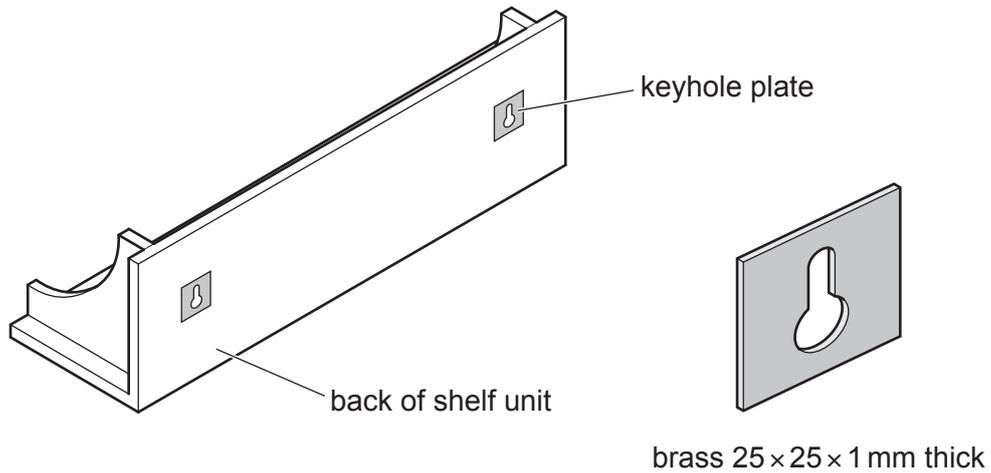


Fig. 6.1

Fig. 6.2 shows a piece of 1 mm thick brass, marked out, ready to produce the keyhole shape. Use sketches and notes to show how the keyhole shape could be produced from the 1 mm thick brass.

Name all the tools and equipment used.

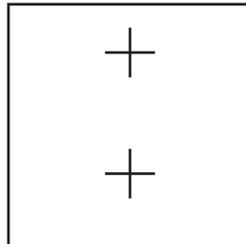


Fig. 6.2

[3]

7 Fig. 7.1 shows a table number stand used in a cafe and a development (net) of the stand.

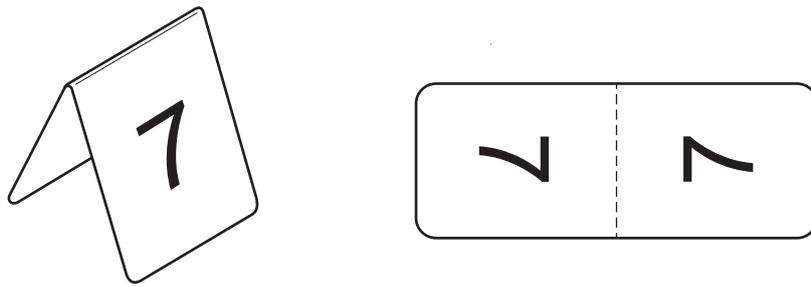


Fig. 7.1

(a) Name a suitable non-ferrous metal for the number stand.

..... [1]

(b) A batch of 20 number stands will be made in a school workshop.
Describe how **20** identical number stands could be marked out onto a sheet of metal.

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

8 Fig. 8.1 shows a through housing joint marked out on a length of hardwood.

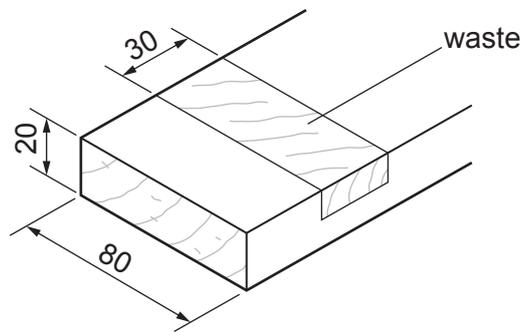


Fig. 8.1

Complete Table 8.1 by describing the process each tool is used for when marking out and/or cutting out the through housing joint.

Table 8.1

Tool	Description of process
Cutting gauge	
Tenon saw	
Bevel-edge chisel	

[3]

9 **Circle** from the list below **one** material that is biodegradable.

polystyrene

hardboard

tin

nylon

copper

[1]

10 Fig. 10.1 shows a trophy made of 5 mm thick acrylic.
The trophy has been produced using CAD/CAM.
The words 'Top Team 2023' have been engraved on the star shape of the trophy.

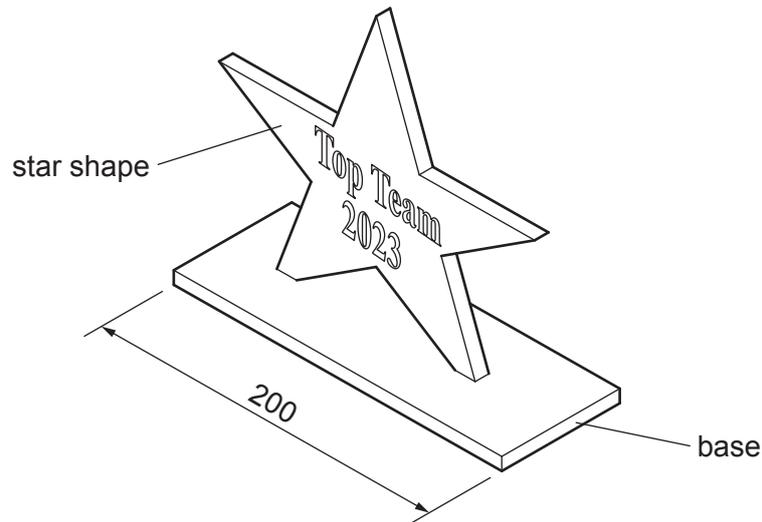


Fig. 10.1

Complete Table 10.1 by describing **three** stages that could be carried out to produce the engraved words on the star shape of the trophy using CAD/CAM.

Table 10.1

Stage	Description of stage
1	<i>Design star shape of trophy using appropriate software</i>
2	
3	
4	
5	<i>Start CNC machine</i>

[3]

Section B

Answer **one** question from this section.

11 Fig. 11.1 shows an incomplete design for a guitar stand.

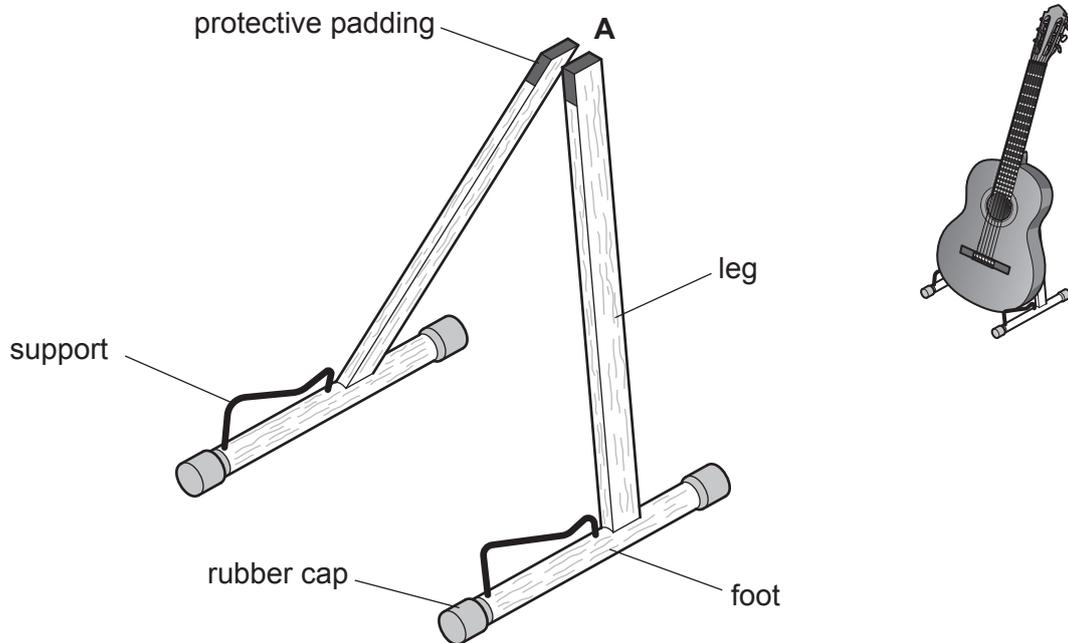


Fig. 11.1

Table 11.1 shows a parts list for the guitar stand.

Table 11.1

Part	No. reqd.	Length	x	Width	x	Thickness	Material
leg	2	400	x	30	x	15	beech
foot	2	280	x	Ø30			beech
support	2	250	x	Ø6			aluminium

(a) The designer of the guitar stand would consider a number of specification points when designing the guitar stand.

Add **two** further specification points to the list below.

The guitar stand must:

- *be adjustable to support different types of guitar*
-
-

[2]

(b) Fig. 11.2 shows the end of a leg and part of the foot that will be joined together.

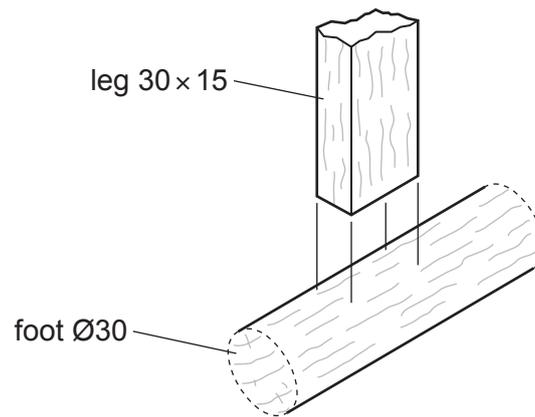


Fig. 11.2

Sketch and name a suitable method of joining the leg to the foot permanently.

[4]

(c) The legs will be hinged at position **A** shown in Fig. 11.1.
Sketch and name a suitable hinge that could be used at position **A** shown in Fig. 11.1.

[4]

- (d) The feet will be produced using a woodturning lathe.
Fig. 11.3 shows a length of beech ready to be turned on a woodturning lathe.

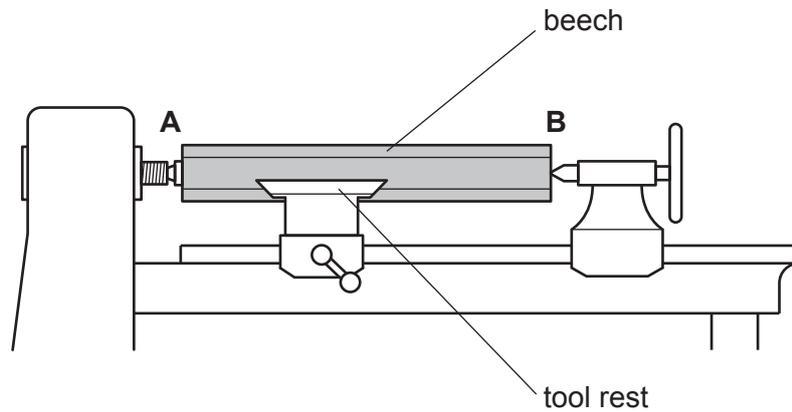


Fig. 11.3

- (i) State **one** property of beech that makes it suitable for woodturning.
..... [1]
- (ii) A saw cut has been made in the end of the length of beech at **A** in Fig. 11.3.
State the purpose of the saw cut.
..... [1]
- (iii) Candle wax is often applied to the end of the length of beech at **B** in Fig. 11.3.
State the purpose of the candle wax.
..... [1]
- (iv) State **one** reason why it is important to set the tool rest at the correct height before starting to turn the length of beech.
..... [1]

- (e) The supports of the guitar stand are made of $\text{Ø}6$ aluminium rod covered with a protective padding.

Fig. 11.4 shows details of one support with the protective padding removed.

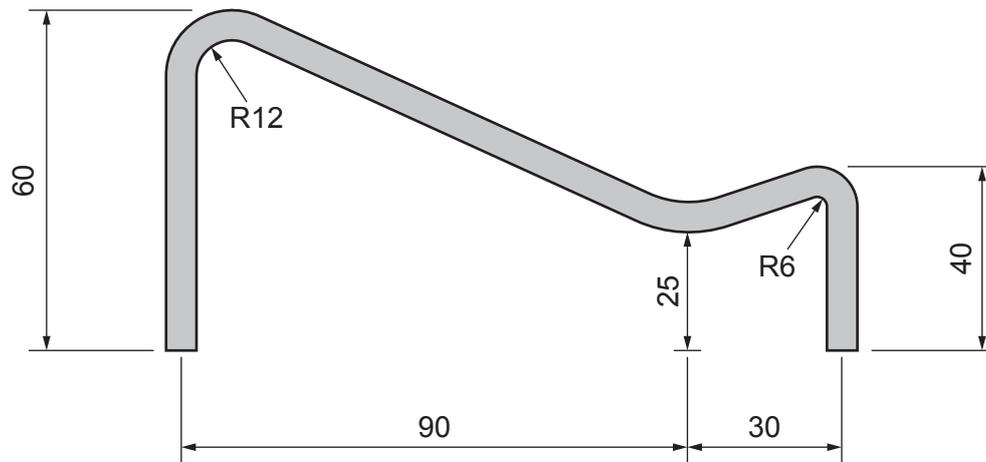


Fig. 11.4

Use sketches and notes to show how a 250 mm length of aluminium rod could be formed to the shape of the support.

Name all the tools and equipment used to produce the support.

[4]

- (f) Fig. 11.5 shows a front view of the guitar stand. The guitar stand will be made adjustable to support different types and sizes of guitar. The hinged legs need to be opened or closed and locked apart at different distances.

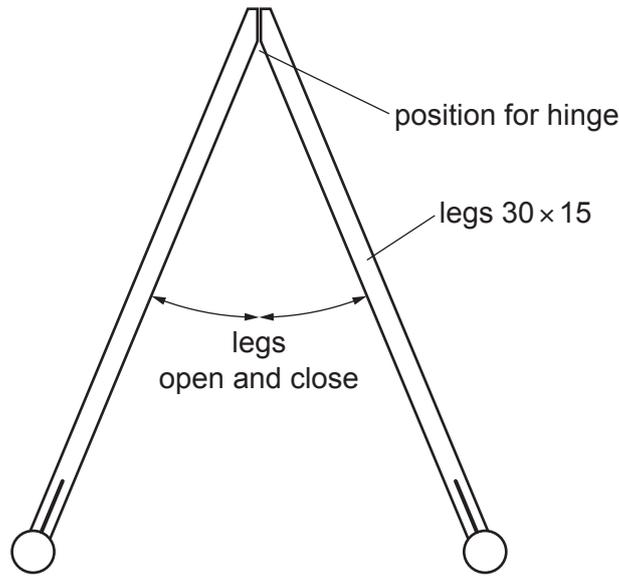


Fig. 11.5

Use sketches and notes to show how the hinged legs could be locked apart at different distances. Give details of additional materials and constructions used.

[5]

- (g) The guitar stand is made from two main materials: beech and aluminium. Explain why beech is a more sustainable material than aluminium.

.....

.....

..... [2]

12 Fig. 12.1 shows views of an incomplete design for a coin box used by children. The coin box is made mainly from MDF. Coins are placed in the Ø30 holes, the handle is turned, the top disk rotates and coins fall into the box.

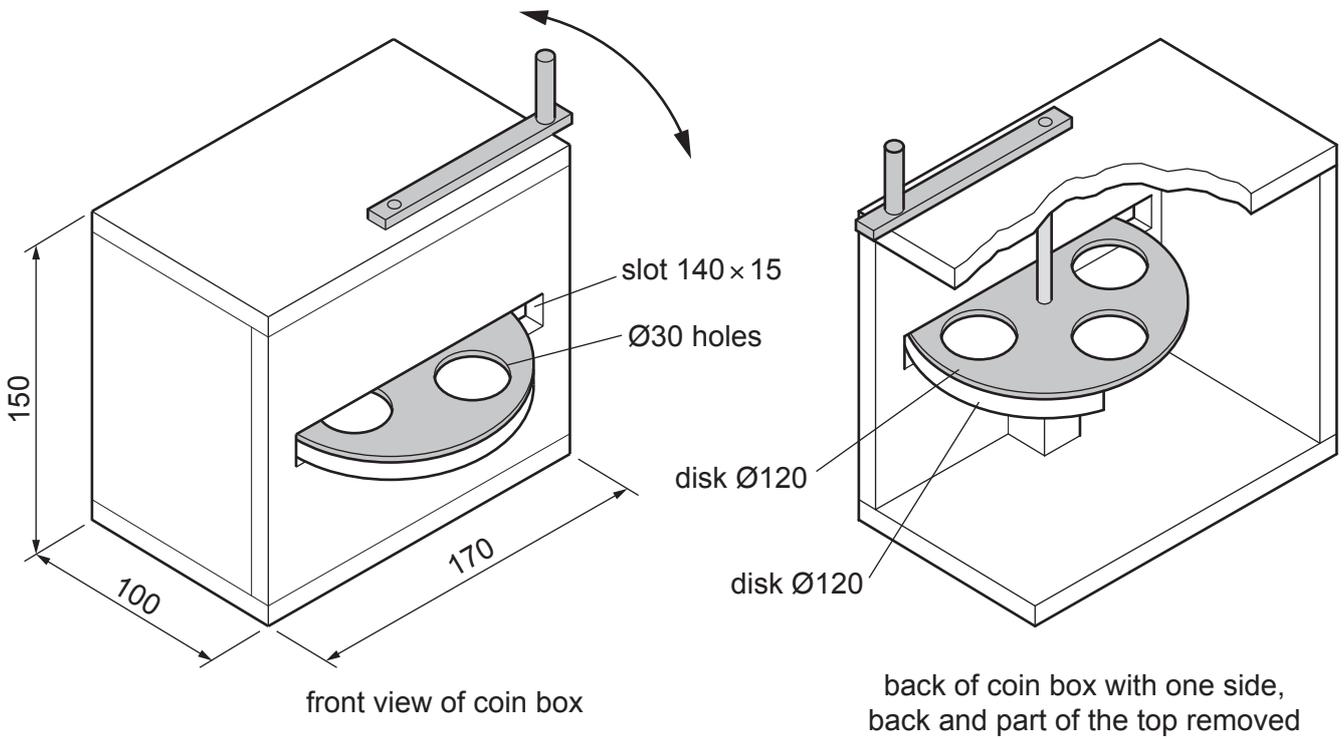


Fig. 12.1

(a) Table 12.1 shows a parts list for the coin box. Complete Table 12.1 by providing the missing dimensions.

Table 12.1

Part	No. required	Length	x	Width	x	Thickness	Material
front	1	170	x	<input type="text"/>	x	10	MDF
side	2	<input type="text"/>		<input type="text"/>	x	10	MDF
base	1	170	x	100	x	10	MDF
top	1	170	x	100	x	10	MDF

[3]

- (b) Fig. 12.2 shows the top of the coin box marked out and cut to length. A small amount of waste remains and must be removed to make the ends flat and square.

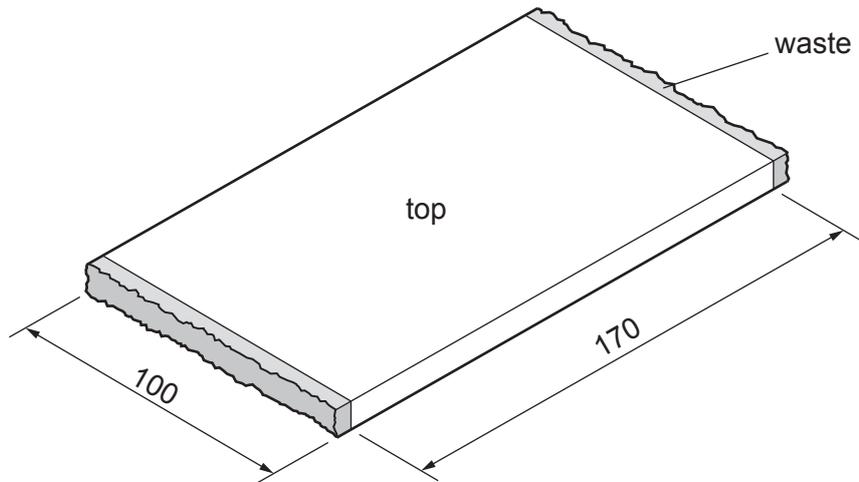


Fig. 12.2

- (i) Use sketches and notes to show how the waste could be removed using a smoothing plane. Show clearly how the MDF could be held securely while it is planed.

[3]

- (ii) Use sketches and notes to show how the ends could be checked for squareness after they have been planed. State the name of the tool used.

[3]

(c) Fig. 12.3 shows the slot in the front of the coin box.

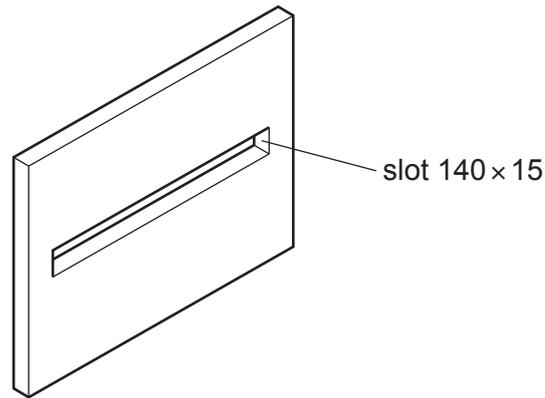


Fig. 12.3

State the name of a machine that could be used to cut out the slot in the front of the coin box.

..... [1]

(d) Fig. 12.4 shows part of the front, top and side of the coin box. All the parts of the coin box will be glued and nailed to produce the finished box.

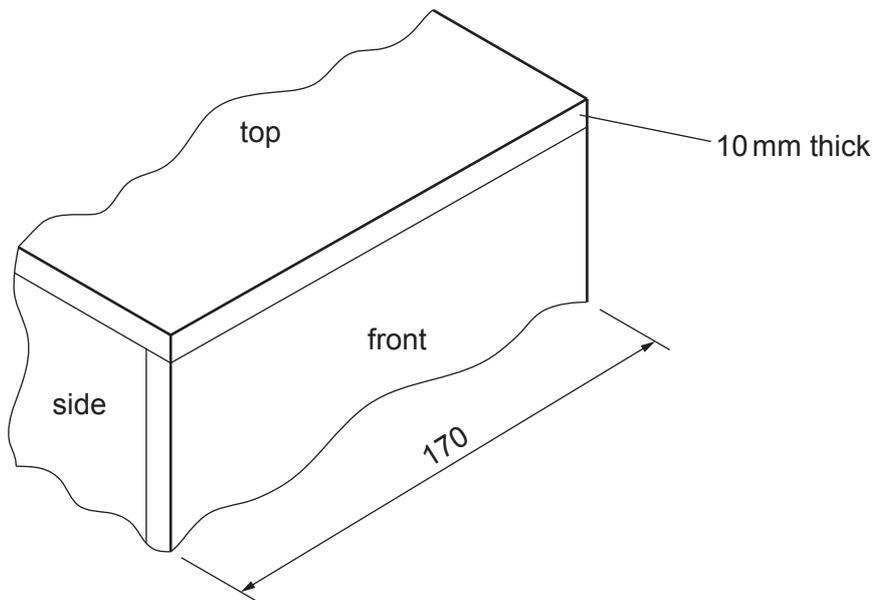


Fig. 12.4

(i) State a suitable type of nail that could be used to join the top of the coin box to the front.

..... [1]

(ii) State an appropriate length of nail that could be used to join the top of the coin box to the front.

..... [1]

(iii) Draw on Fig. 12.4 to show the number of nails that could be used to join the top of the coin box to the front and the distance between each of the nails used. [2]

- (e) Fig. 12.5 shows two sheets of MDF from which the disks will be produced. The two sheets of MDF will be glued to each side of a sheet of drawing paper.

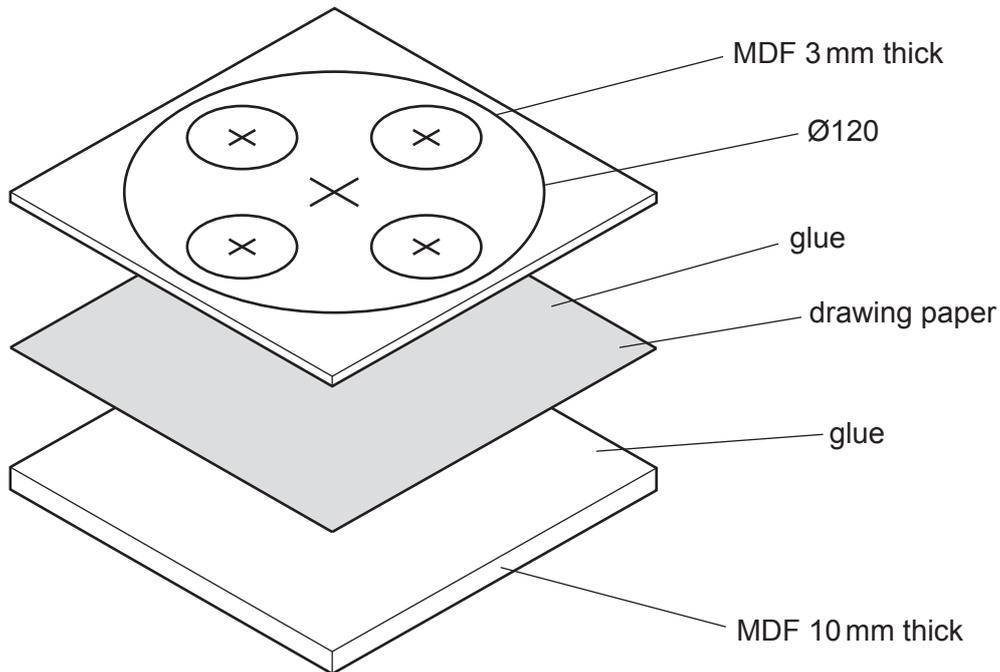


Fig. 12.5

- (i) State the purpose of the drawing paper that will be glued to each disk.

..... [1]

- (ii) Use sketches and notes to show how the disks could be cut out and shaped from the sheets of MDF.
Name all the tools and equipment used.

[3]

(f) Fig. 12.6 shows a drill bit that could be used to drill the Ø30 holes in the 3 mm thick disk.



Fig. 12.6

(i) Name the type of drill bit shown in Fig. 12.6.

..... [1]

(ii) State **one** safety check, other than Personal Protective Equipment (PPE), that must be carried out before switching on the drilling machine.

..... [1]

(g) Children need to access the coins that have fallen into the box. Fig. 12.7 shows details of the coin box with the back removed.

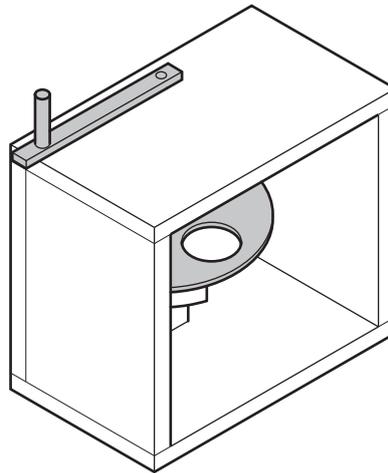


Fig. 12.7

Use sketches and notes to show how a back could be made to fit the coin box but be removed easily and quickly.

Show details of all materials and constructions used.

- 13 Fig. 13.1 shows a bird feeder made of 5 mm thick clear acrylic. The bird feeder has an outer case made from one length of acrylic folded and joined at A. The bird feeder has an identical front and back, each joined to the edges of the outer case.

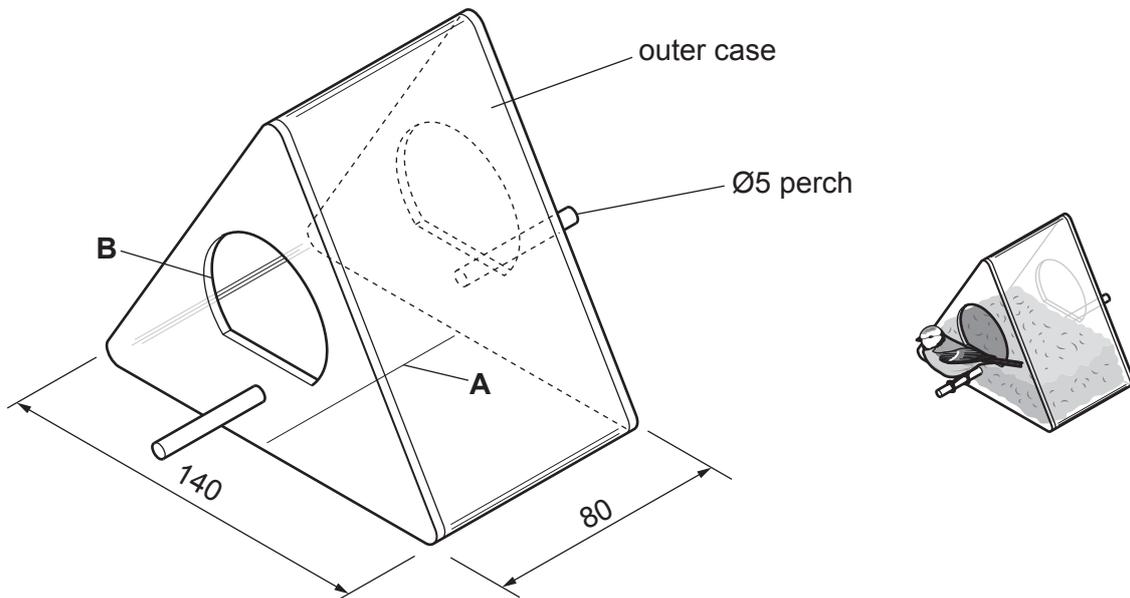


Fig. 13.1

- (a) Give **two** benefits of using acrylic for the bird feeder.

1

2

[2]

- (b) Fig. 13.2 shows the development (net) of the outer case marked out, ready to be bent to shape.

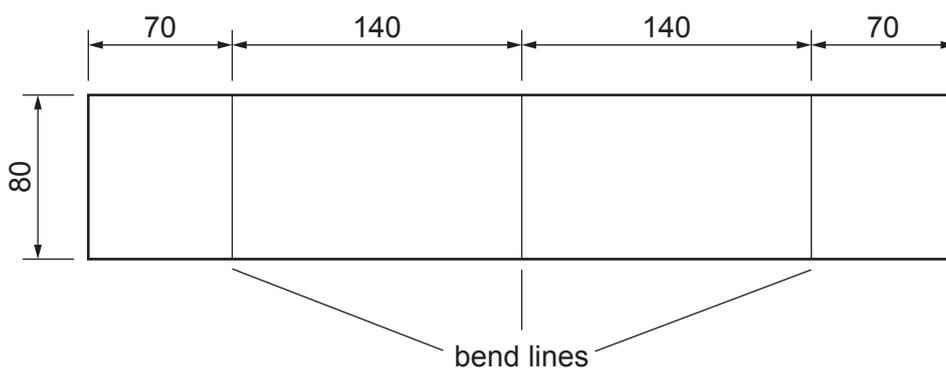


Fig. 13.2

- (i) Name **two** tools or items of equipment that could be used to mark the bend lines on the surface of the acrylic sheet.

1

2

[2]

- (ii) Use sketches and notes to show a bending jig or former that could be used when bending the acrylic to the shape of the outer case.

[2]

- (iii) Describe in detail how the development (net) of the outer case could be bent to shape.

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

- (c) Fig. 13.3 shows the front of the bird feeder with the Ø5 hole and shape B marked out.

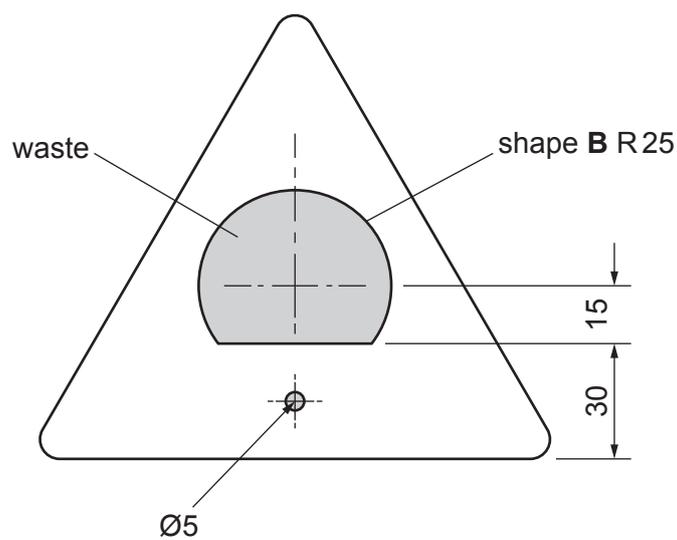


Fig. 13.3

- (i) Use sketches and notes to show how the front part of the bird feeder could be held securely to prevent damage to the acrylic sheet when the Ø5 hole is drilled.

[3]

- (ii) Name a suitable tool that could be used to mark out the arc section of shape **B**.

..... [1]

- (iii) Use sketches and notes to show how shape **B** could be cut out and the edges made smooth. Name all the tools and equipment used.

[4]

- (d) (i) The front and back of the bird feeder will be joined to the outer case by means of acrylic cement.
State **two** reasons why acrylic cement could be considered a potentially dangerous substance.

1

2

[2]

- (ii) Use sketches and notes to show how the front and back parts of the bird feeder could be held securely in place while the acrylic cement sets.
Name the equipment used.

[3]

- (e) Use sketches and notes to show a modification to the design of the bird feeder so that it could be suspended from a branch of a tree.

[3]

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