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## DESIGN & TECHNOLOGY

0445/31

Paper 3 Resistant Materials

May/June 2022

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

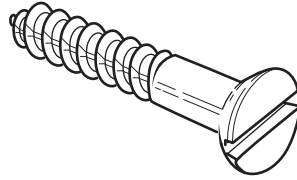
- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].
- All dimensions are in millimetres.

This document has **20** pages.

**Section A**

Answer **all** questions in this section.

1 Fig. 1.1 shows a screw.



**Fig. 1.1**

Give **three** additional items of information required when ordering 200 of the screws shown in Fig. 1.1.

1 Number of screws required- 200

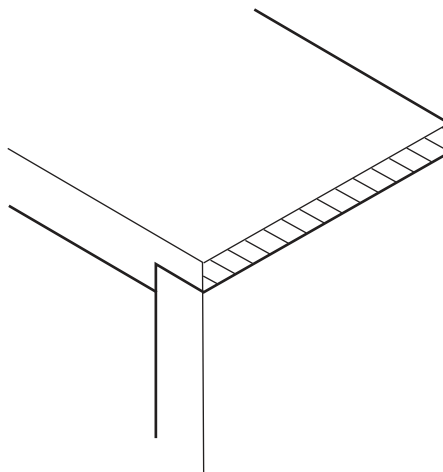
2 .....

3 .....

4 .....

[3]

2 Fig. 2.1 shows two pieces of softwood glued together.



**Fig. 2.1**

(a) Name the type of joint shown in Fig. 2.1.

..... [1]

(b) Add sketches to Fig. 2.1 to show how the joint could be strengthened by dovetail nailing.

[2]

3 Fig. 3.1 shows three different types of 'square', **A**, **B** and **C**, that could be used when marking out and testing.

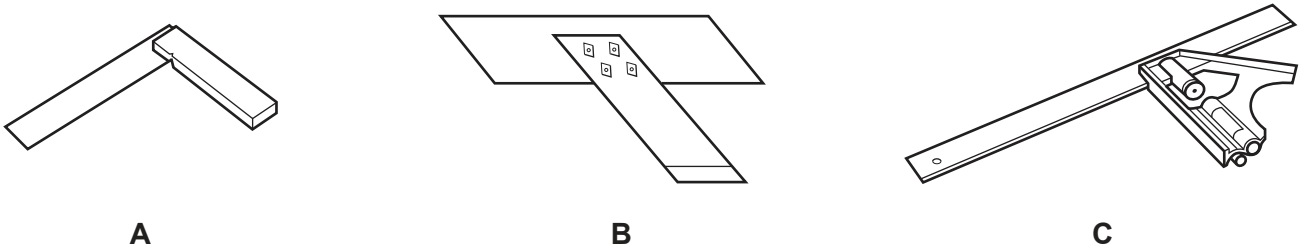


Fig. 3.1

Give the correct name for each type of square shown in Fig. 3.1.

**A** ..... square

**B** ..... square

**C** ..... square

[3]

4 Fig. 4.1 shows a sundial that could be made in a school workshop.

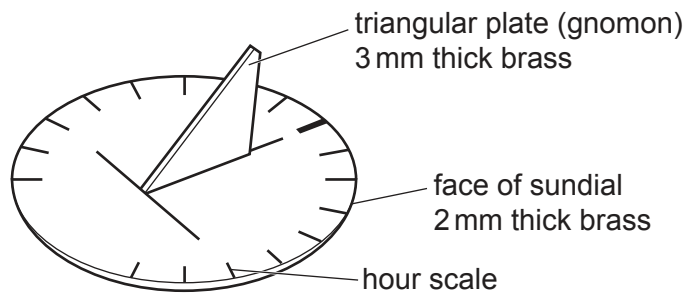


Fig. 4.1

The triangular plate will be attached to the face of the sundial by means of silver soldering. Complete Table 4.1 by stating **three** further stages in the silver soldering process.

Table 4.1

Stage	Process
1	<i>Clean joint with emery cloth</i>
2	
3	
4	

[3]

- 5 Fig. 5.1 shows a slot marked out on sheet material.  
A hole has been drilled to allow a saw blade to be inserted to cut out the slot.

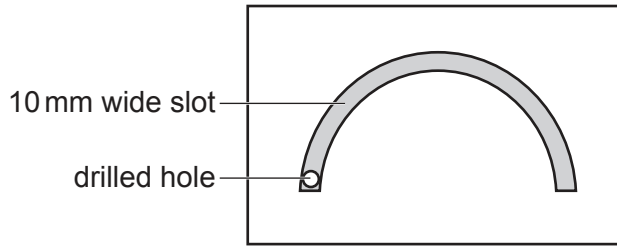


Fig. 5.1

Name a specific type of saw suitable for cutting out the slot when the material is:

- (a) 4 mm thick plywood ..... [1]  
 (b) 1 mm thick brass ..... [1]

- 6 Fig. 6.1 shows plastic tableware for outdoor use.  
The tableware is made from melamine formaldehyde.



Fig. 6.1

Give **two** reasons why melamine formaldehyde is a suitable material for the tableware.

- 1 .....  
 2 ..... [2]

- 7 A list of materials is given below.

acrylic                  redwood                  polystyrene                  carbon steel

- Circle from the list **one** material that is from a sustainable source. [1]

8 Fig. 8.1 shows two tools, **A** and **B**, that are used to mark lines parallel to the edges of materials.

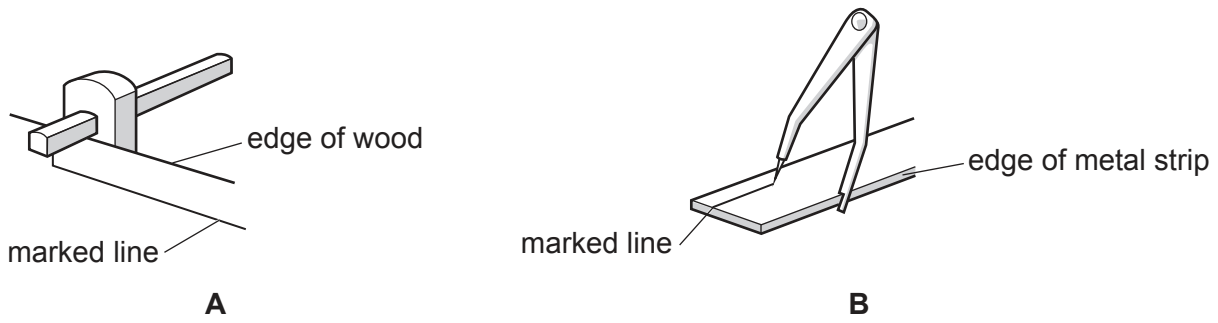


Fig. 8.1

Name tools **A** and **B** shown in Fig. 8.1.

Tool **A** .....

Tool **B** .....

[2]

9 Fig. 9.1 shows a storage unit for three remote controls. The storage unit has two sides, a base and four partitions made from 5 mm thick MDF. The storage unit is supplied as flat pack for customers to self-assemble.

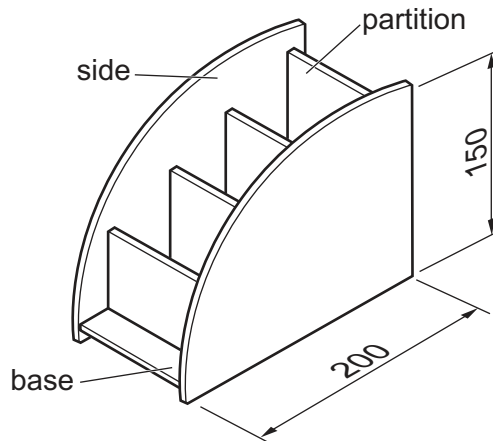
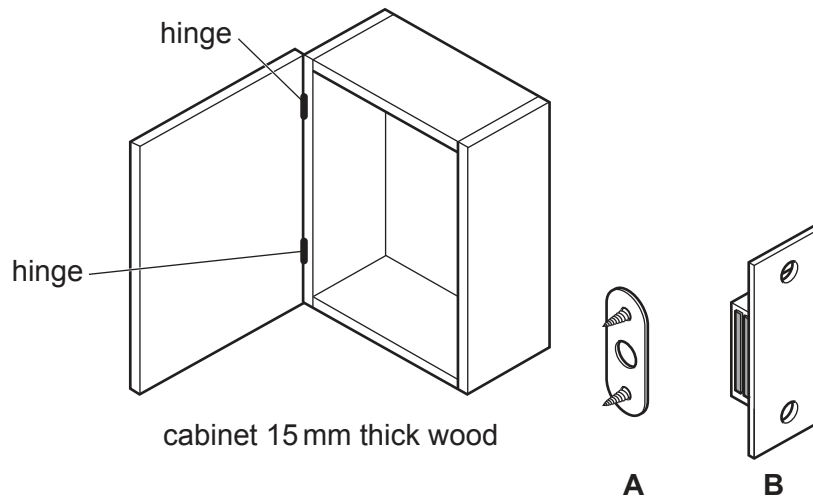


Fig. 9.1

Use sketches and notes to show **one** construction method that could be used to join the parts of the storage unit together **without** the use of any tools, adhesive or additional fittings.

[3]

10 Fig. 10.1 shows a cabinet with a hinged door and parts **A** and **B** of a magnetic door catch.



**Fig. 10.1**

(a) Show clearly on Fig. 10.1 where each part of the magnetic door catch, **A** and **B**, would be attached to the cabinet. [2]

(b) Name a suitable type of hinge that could be used in the positions shown in Fig. 10.1.

..... [1]

## Section B

Answer **one** question from this section.

- 11 Fig. 11.1 shows views of a table that will be assembled by customers. The parts of the table are joined by means of knock-down (KD) fittings.

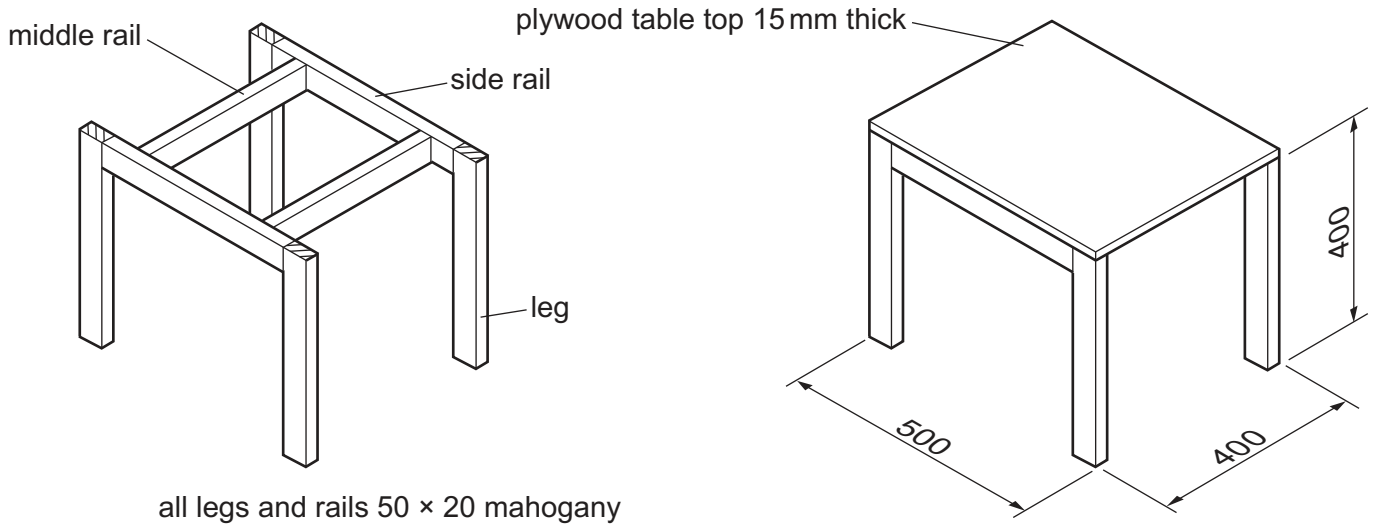


Fig. 11.1

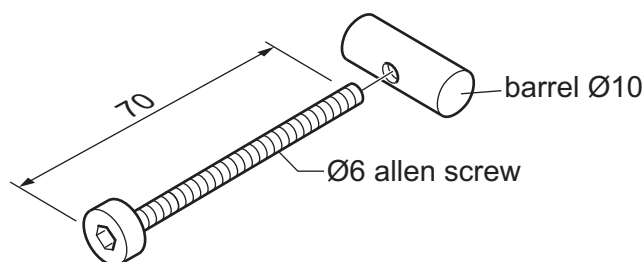
- (a) Give **two** reasons why mahogany is a suitable hardwood for the legs and rails of the table.

1 .....

2 .....

[2]

- (b) Use sketches and notes to show how the scan fitting shown below could be used to join a side rail to a leg.



[3]

(c) Corner block knock-down (KD) fittings will be used to join the middle rails to the side rails.

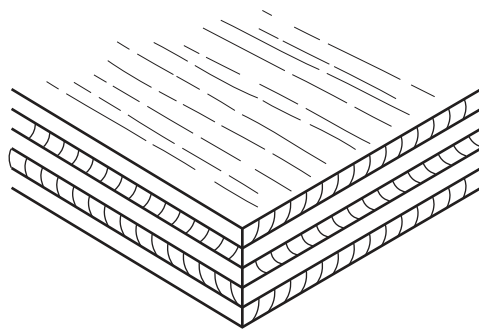
(i) Draw an accurate sketch of a corner block knock-down (KD) fitting.

[2]

(ii) Use sketches and notes to show how **one** corner block knock-down (KD) fitting could be used to join the middle rail to the side rail.

[2]

(d) Fig. 11.2 shows the edges of the plywood table top.



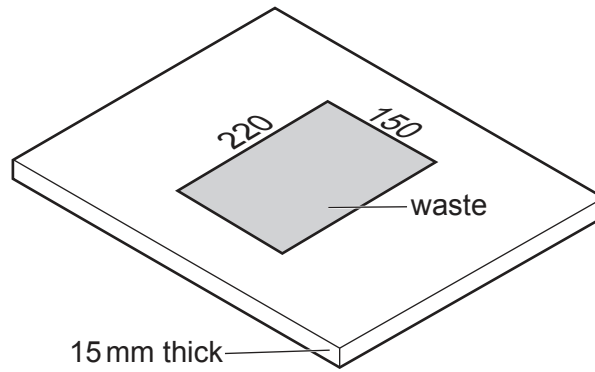
**Fig. 11.2**

(i) Use sketches and notes to show how the appearance of the edges of the plywood could be made to look attractive.

[2]



- (ii) A sheet of 6 mm thick glass is to be set into the plywood table top. Fig. 11.3 shows the waste material to be removed to allow the glass to be set in.



**Fig. 11.3**

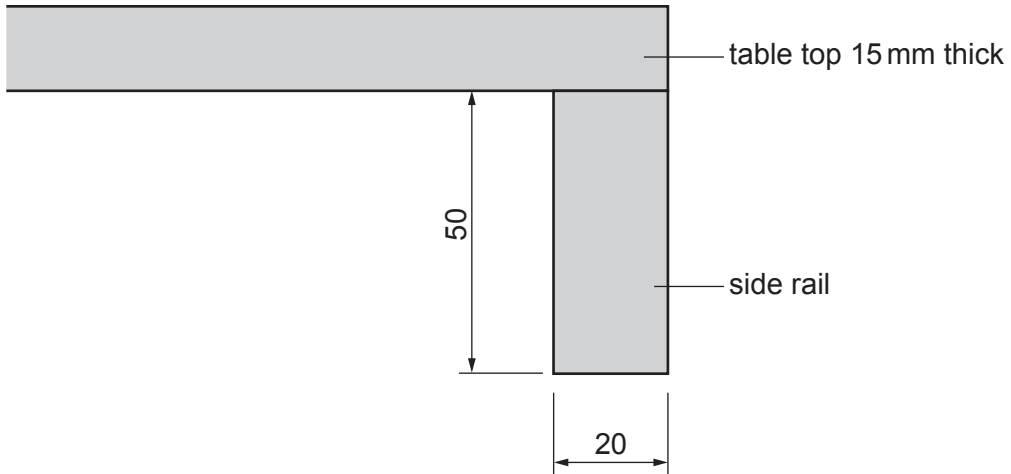
Use sketches and notes to show how the waste material could be removed.

[3]

- (iii) Use sketches and notes to show how the 6 mm thick glass sheet could be supported inside the 15 mm thick plywood table top.

[3]

(iv) Fig. 11.4 shows a sectional view through the table top and side rail.



**Fig. 11.4**

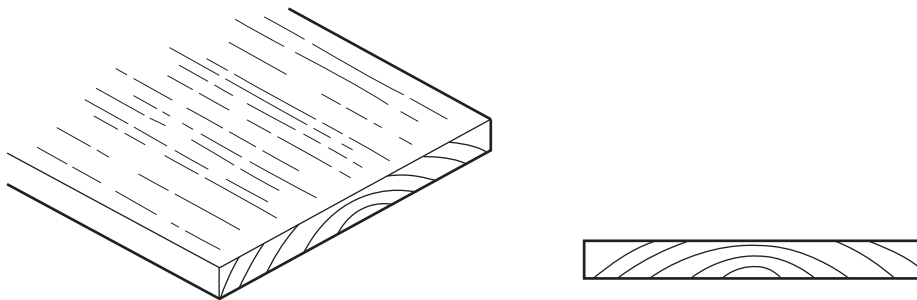
Add sketches and notes to Fig. 11.4 to show how **one** screw could be used to fasten the side rail to the underside of the table top. The screw head must not be visible. State the length of the screw used. [3]

(e) When trees are felled, (cut down), they are cut into boards, (converted) and seasoned.

(i) State the meaning of the term 'seasoned'.

..... [1]

(ii) Fig. 11.5 shows views of part of a table top made from solid wood.



**Fig. 11.5**

Sketch, onto Fig. 11.5, to show what could happen to the shape of the solid wood table top if it was seasoned incorrectly. [2]

(f) Give **two** benefits to manufacturers of producing flat pack products that are assembled by customers.

1 .....

2 .....

[2]

- 12 Fig. 12.1 shows details of a desktop toy. The suspended weight can be made to swing forwards and backwards around a central pivot.

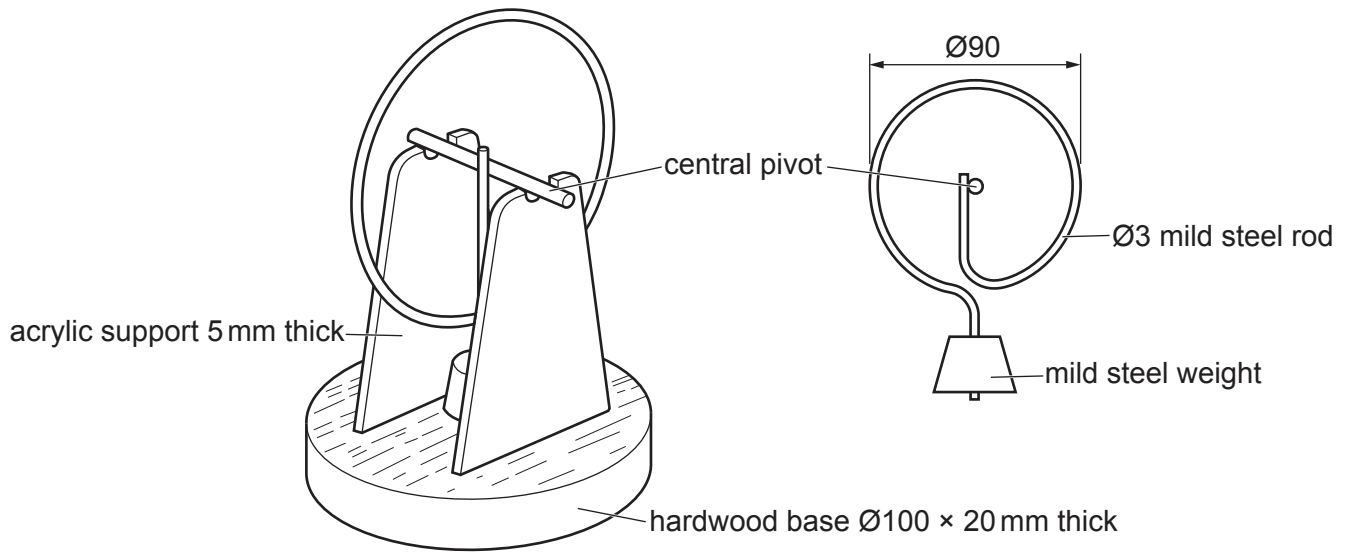


Fig. 12.1

- (a) Fig. 12.2 shows the hardwood base marked out ready to be cut to shape.

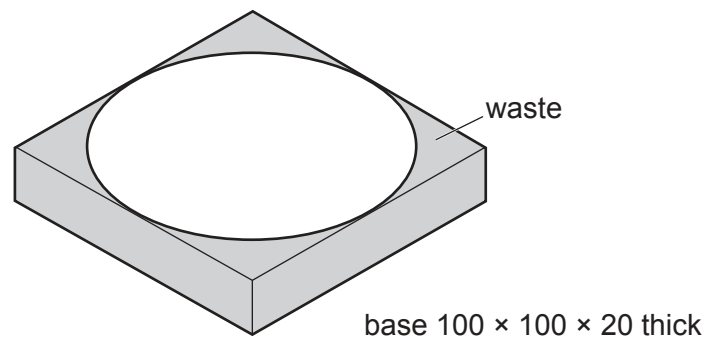


Fig. 12.2

Use sketches and notes to show how the base could be produced.  
Name the tools and equipment used.

- (b) Fig. 12.3 shows one of the supports marked out, ready to be cut out of 5 mm thick acrylic sheet.

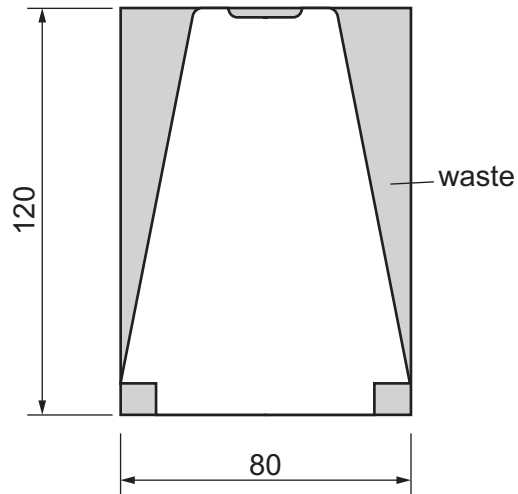


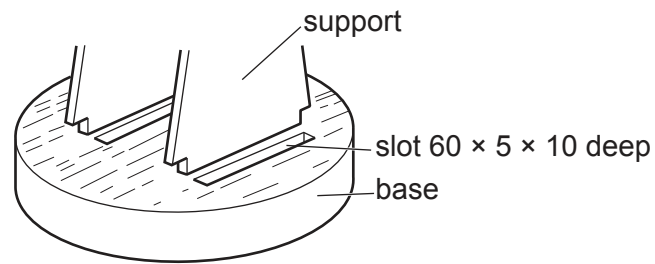
Fig. 12.3

Use sketches and notes to show how **two** identical supports could be produced.

Include the following details to show how:

- the shape could be cut from the acrylic sheet
- the cut edges could be made flat
- the edges could be polished to a high quality.

(c) Fig. 12.4 shows how the supports will be joined to the base.

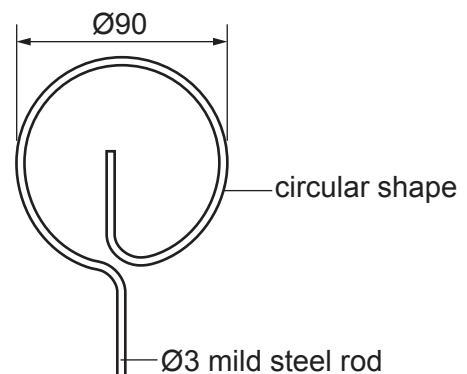


**Fig. 12.4**

Use sketches and notes to show how the slots could be cut out of the hardwood base. Name all the tools and equipment used.

[3]

(d) The circular shape will be produced by cold bending the  $\text{Ø}3$  mild steel rod using a jig and/or former. Use sketches and notes to show a design for a jig and/or former that could be used to produce the circular shape.



[5]

- (e) The mild steel weight could be produced on a centre lathe. Fig. 12.5 shows three lathe operations, **A**, **B** and **C**, that could be used to produce the mild steel weight.

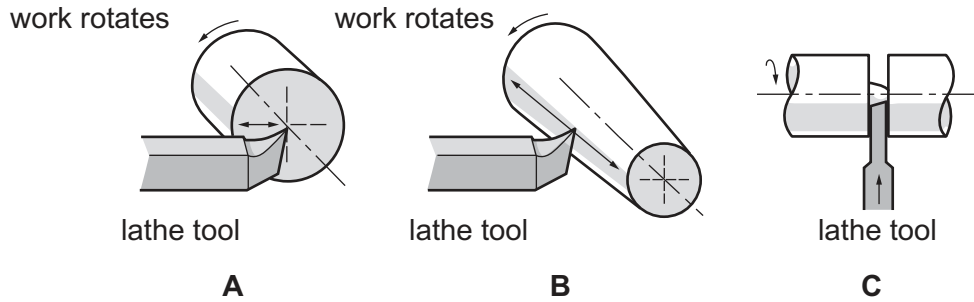


Fig. 12.5

Complete the names of each of the **three** centre lathe operations **A**, **B** and **C**.

**A** ..... off

**B** ..... turning

**C** ..... off

[3]

- (f) Fig. 12.6 shows how the  $\text{Ø}3$  mild steel rod will be joined to the mild steel weight by means of a screw thread.

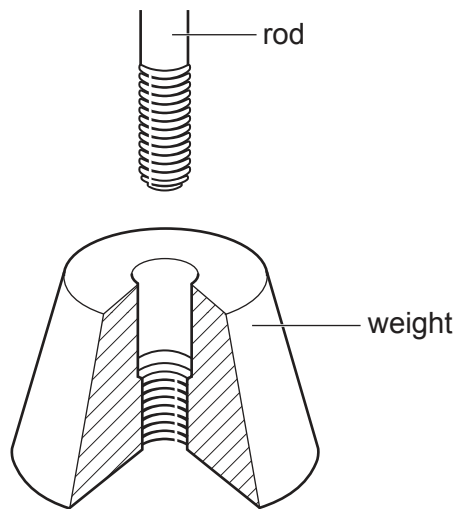


Fig. 12.6

Name the tool used to cut the screw thread:

- (i) inside the weight

..... [1]

- (ii) on the rod.

..... [1]

(g) (i) State **two** different finishes that could be applied to the mild steel parts of the desktop toy.

1 .....

2 .....

[2]

(ii) The hardwood base requires a finish to preserve the wood and enhance its appearance. Give **one** reason why a **clear** finish would be applied to the hardwood base.

..... [1]

- 13 Fig. 13.1 shows an incomplete design for a wind gauge that could be made in a school workshop. The cups and arms rotate when the wind blows.

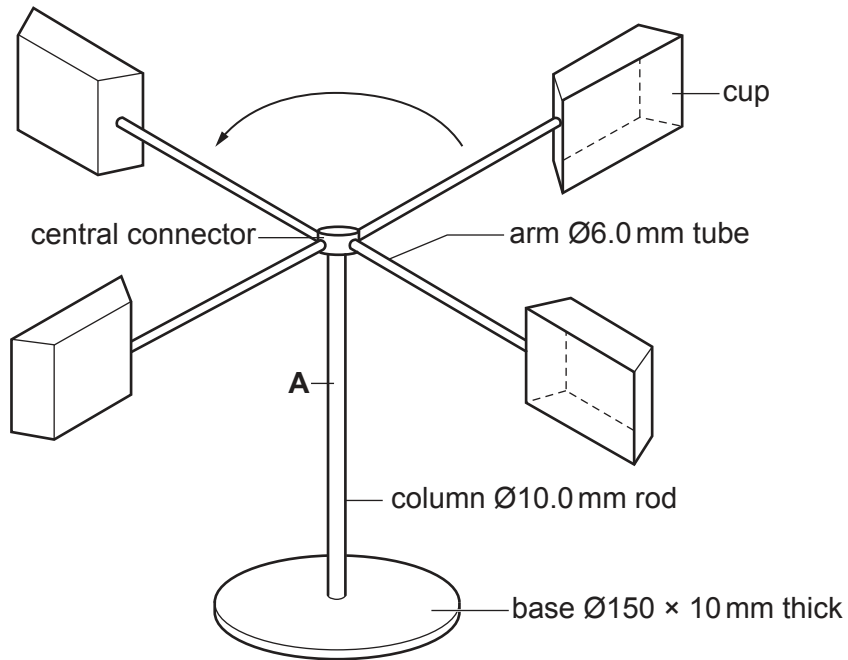


Fig. 13.1

- (a) State **two** benefits of using plastic materials for the parts of the wind gauge.

1 .....

2 ..... [2]

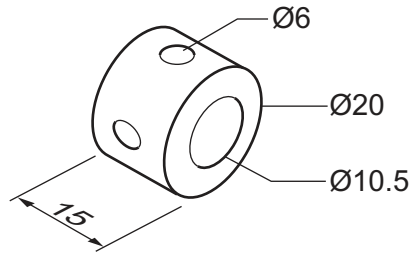
- (b) Give **two** reasons why a designer would make a model of the wind gauge before making it from resistant materials.

1 .....

2 ..... [2]

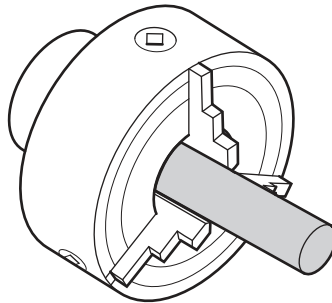


- (c) Fig. 13.2 shows details of the central connector.  
 The central connector will be made from a 15 mm section of  $\text{Ø}20$  acrylic rod.  
 The  $\text{Ø}10.5$  hole in the connector will be drilled while the acrylic rod is held in a three jaw chuck on a centre lathe.



**Fig. 13.2**

Fig. 13.3 shows a length of  $\text{Ø}20$  acrylic rod held in a three jaw chuck.



**Fig. 13.3**

- (i) State **one** check that should be carried out before turning on the centre lathe.

..... [1]

- (ii) Fig. 13.4 shows the drill that will produce a small hole to act as a guide for the  $\text{Ø}10.5$  drill.



**Fig. 13.4**

Name the type of drill shown in Fig. 13.4.

..... [1]

- (iii) Fig. 13.5 shows the  $\text{Ø}10.5$  drill that will be used.



**Fig. 13.5**

Name the type of drill shown in Fig. 13.5.

..... [1]

- (iv) Fig. 13.6 shows a saw that could be used to cut a length of acrylic rod to make the connector.

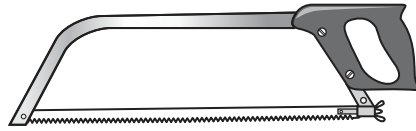


Fig. 13.6

Name the type of saw shown in Fig. 13.6.

..... [1]

- (d) The arms will be joined to the central connector and the cups by means of an 'interference' or 'friction' fit. Explain what is meant by the terms 'interference' or 'friction' fit.

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

- (e) Fig. 13.7 shows details of one of the cups. The cups will be vacuum formed.

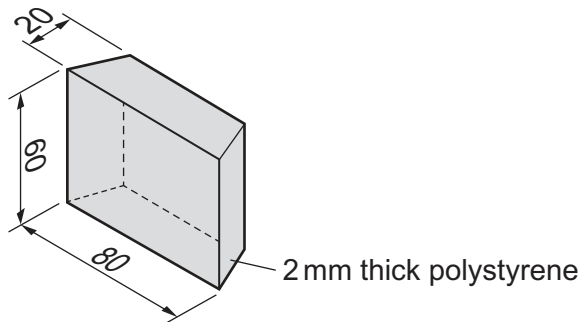
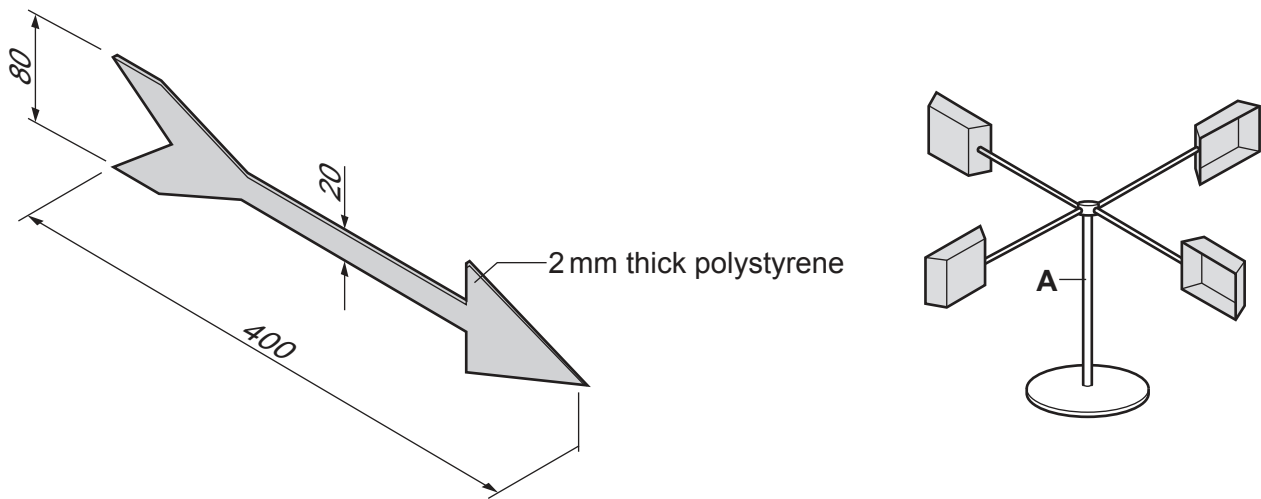


Fig. 13.7

Use sketches and notes to show **four** stages by which the cup could be vacuum formed.

- (f) Fig. 13.8 shows details of a weather vane that will be attached to the column of the wind gauge at position **A**.

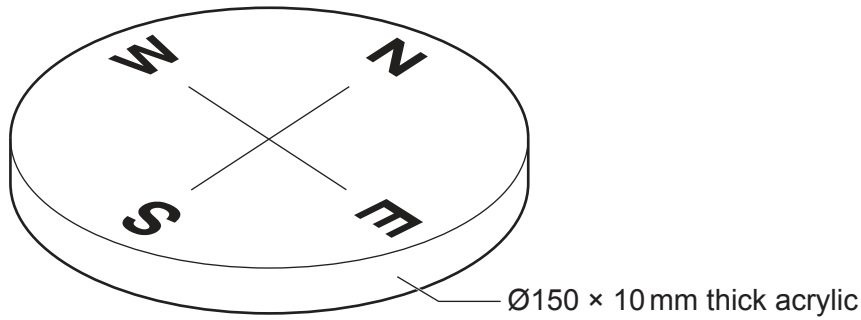


**Fig. 13.8**

Use sketches and notes to show a method of joining the weather vane to the column at point **A** that allows it to rotate freely when the wind blows.

[5]

- (g) Fig. 13.9 shows the base of the wind gauge with the compass points **N** (North), **S** (South), **E** (East) and **W** (West) indicated.



**Fig. 13.9**

Describe, in detail, how the letters **N**, **S**, **E** and **W** could be produced using CAD/CAM and **either** applied to **or** engraved into the surface of the acrylic base.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

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