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DESIGN & TECHNOLOGY

0445/33

Paper 3 Resistant Materials

May/June 2024

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 unless otherwise stated.

This document has **24** pages. Any blank pages are indicated.



Section A

Answer **all** questions in this section.

- 1 Fig. 1.1 shows a small table. The tabletop could be made from plywood or chipboard.

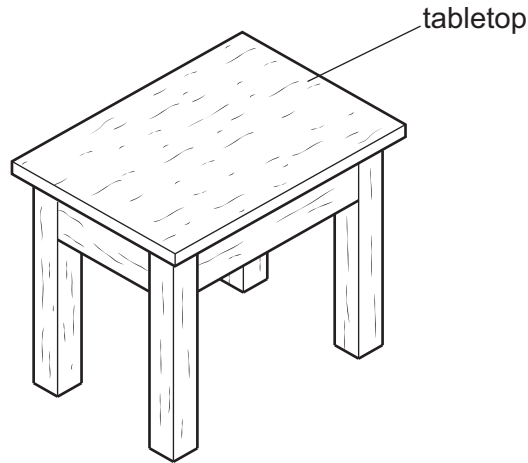


Fig. 1.1

Give **two** advantages of using plywood rather than chipboard for the tabletop.

- 1
- 2 [2]

- 2 Fig. 2.1 shows an incomplete drawing of two pieces of metal being riveted together.

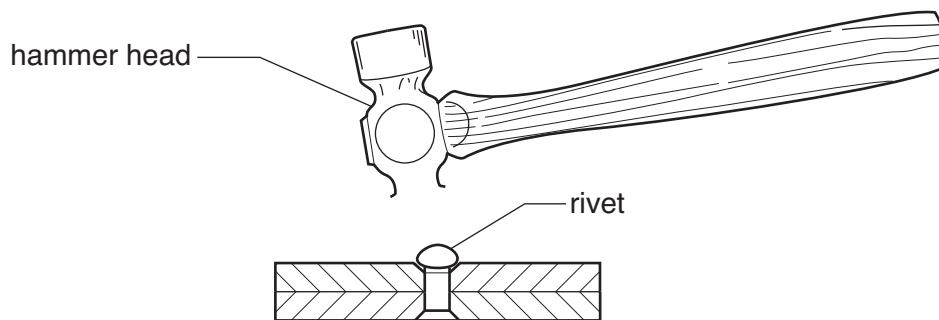


Fig. 2.1

- (a) Name the type of hammer used to rivet the two pieces of metal together.

..... [1]

- (b) Complete the shape of the hammer head that is about to strike the rivet in Fig. 2.1.

[2]





- 3 Fig. 3.1 shows details of a length of 8 mm thick hardwood that has been bent to shape.

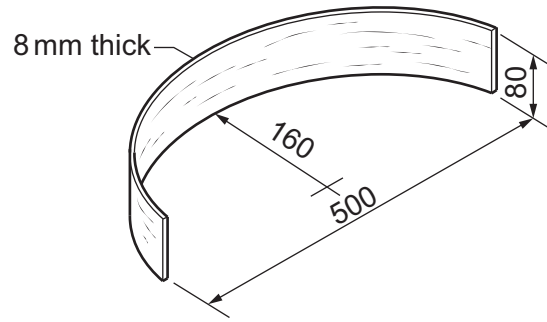


Fig. 3.1

Use sketches and notes to show how formers could have been used to produce the final curved shape.

[3]

- 4 Fig. 4.1 shows a menu stand made from acrylic.

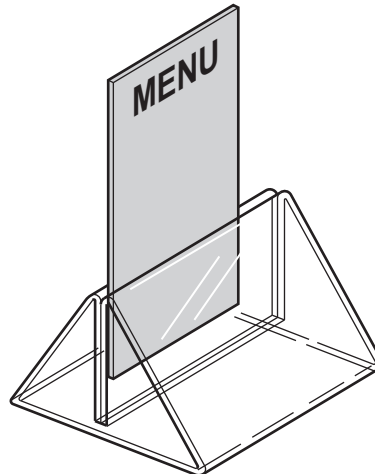


Fig. 4.1

Explain how the designer has used the flexible property of acrylic in the design of the menu stand.

.....

.....

..... [2]





5 Explain the term 'alloy'.

.....

.....

..... [2]

6 Fig. 6.1 shows a wooden box with a 'lift-off' lid.

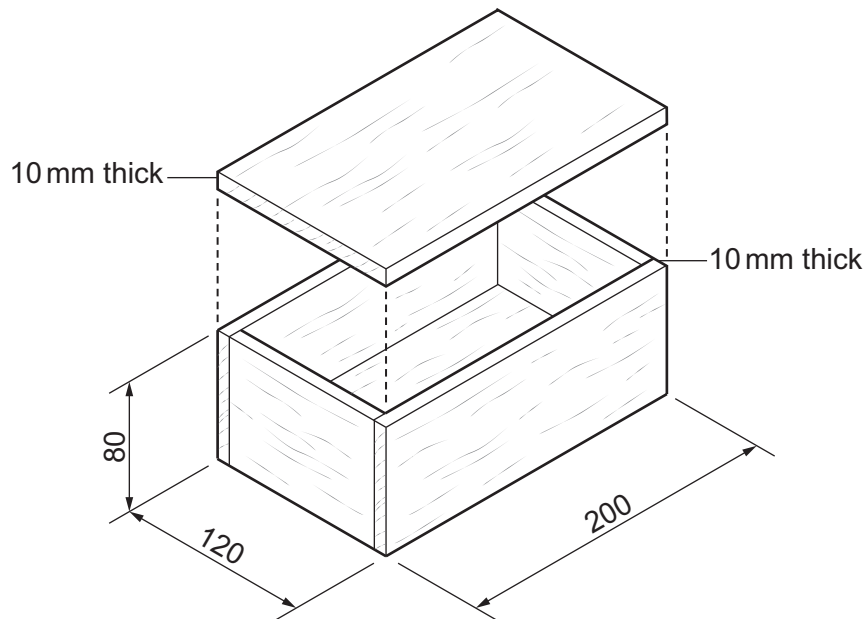


Fig. 6.1

Use sketches and notes to show a modification to the lid so that it could be fitted to **either** the inside of the box **or** to the outside of the box, without the use of hinges.





- 7 Thermochromic materials change colour at specific temperatures.
Describe how the use of thermochromic pigment can improve the function of a product.

.....

.....

.....

..... [2]

- 8 Fig. 8.1 shows a stage in a process to shape thermoplastic sheet.

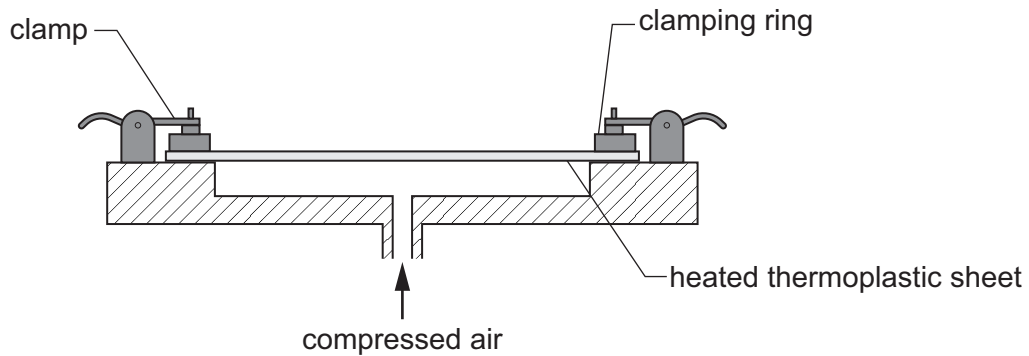


Fig. 8.1

- (a) Name the process shown in Fig. 8.1.

..... [1]

- (b) Draw on Fig. 8.1 to show what happens to the thermoplastic sheet when compressed air is applied. [1]

- 9 Fig. 9.1 shows three wood screws, **A**, **B** and **C**, with different types of head.

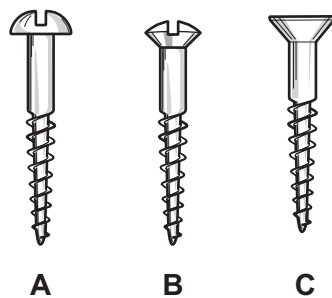


Fig. 9.1

Name the type of head for each of the wood screws **A**, **B** and **C**.

A

B

C [3]





- 10 Fig. 10.1 shows a piercing saw that will be used to cut out the curved shape in a piece of 1 mm thick brass sheet.

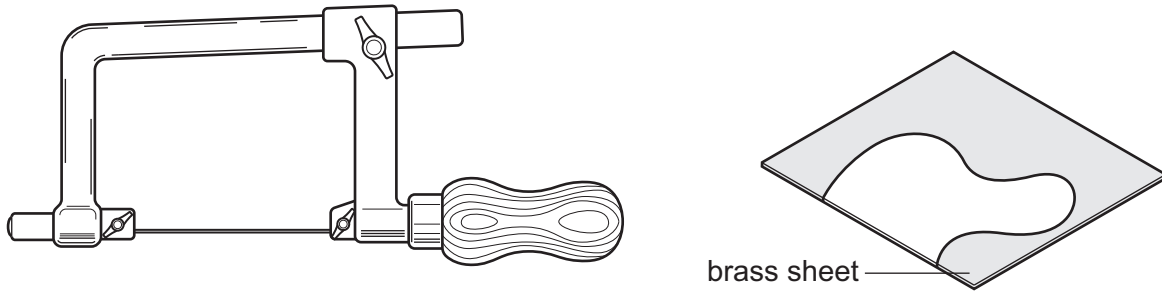


Fig. 10.1

Use sketches and notes to show how the brass sheet would be held securely while the curved shape is cut out.

[3]



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Section B

Answer **one** question from this section.

11 Fig. 11.1 shows views of an incomplete design for a trophy.

The trophy has three main parts made from the following materials:

- front part – 5 mm thick acrylic
- middle part – 2 mm thick brass
- back part – 12 mm thick mahogany.

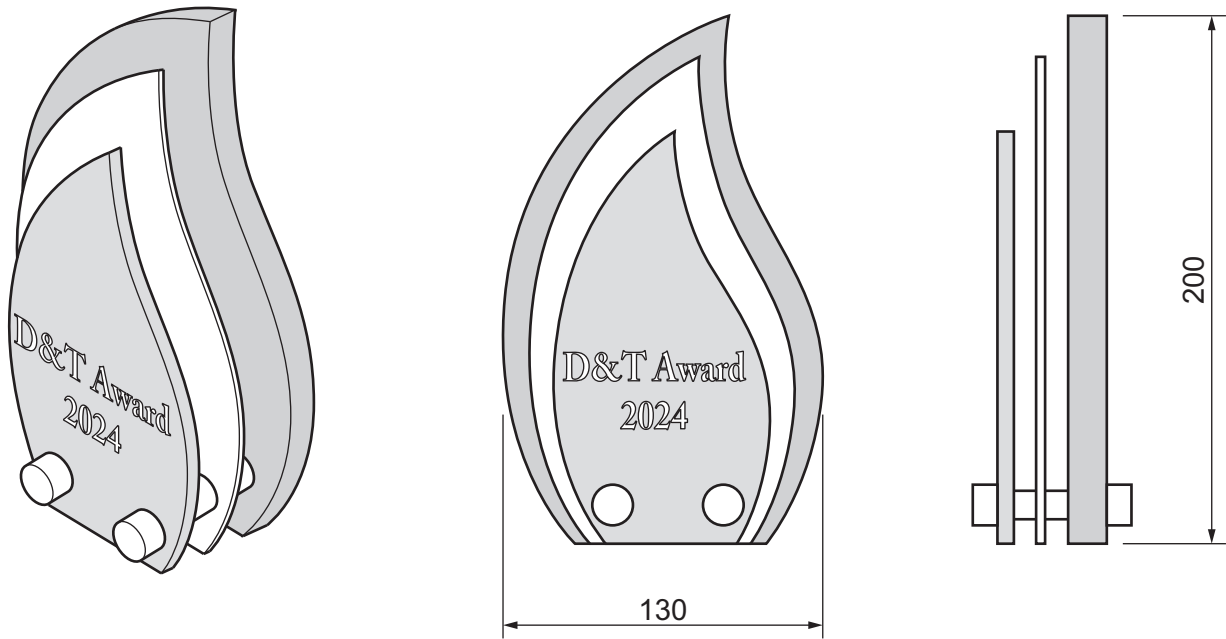


Fig. 11.1

(a) State **two** specification points a designer would have considered when designing the trophy.
The trophy must:

1

2

[2]



- (b) Fig. 11.2 shows a template that could be used to mark out the shape of one of the parts of the trophy.

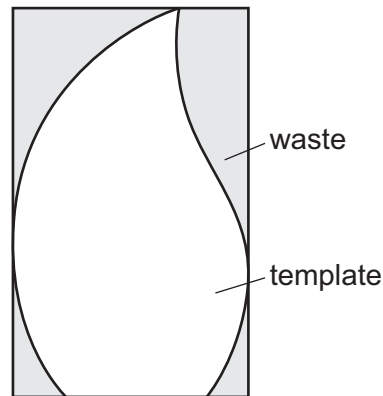


Fig. 11.2

- (i) State **one** benefit of using a template to mark out the shape of one of the parts of the trophy.

..... [1]

- (ii) Use sketches and notes to show how the shape could be cut out from **either** acrylic **or** mahogany and the edges made smooth. Name all the tools and equipment used.

Chosen material

[4]

- (iii) Acrylic and brass are materials that can be self-finished. Explain what is meant by the term 'self-finished'.

.....

 [2]





- (c) Holes will be drilled in the three parts of the trophy to allow the $\varnothing 5$ rod to pass through. Give **two** reasons why sheet material must be clamped securely before holes are drilled through the material.

1

2 [2]

- (d) Fig. 11.3 shows details of the caps, spacers and rod that are used to keep the three parts of the trophy held securely in position.

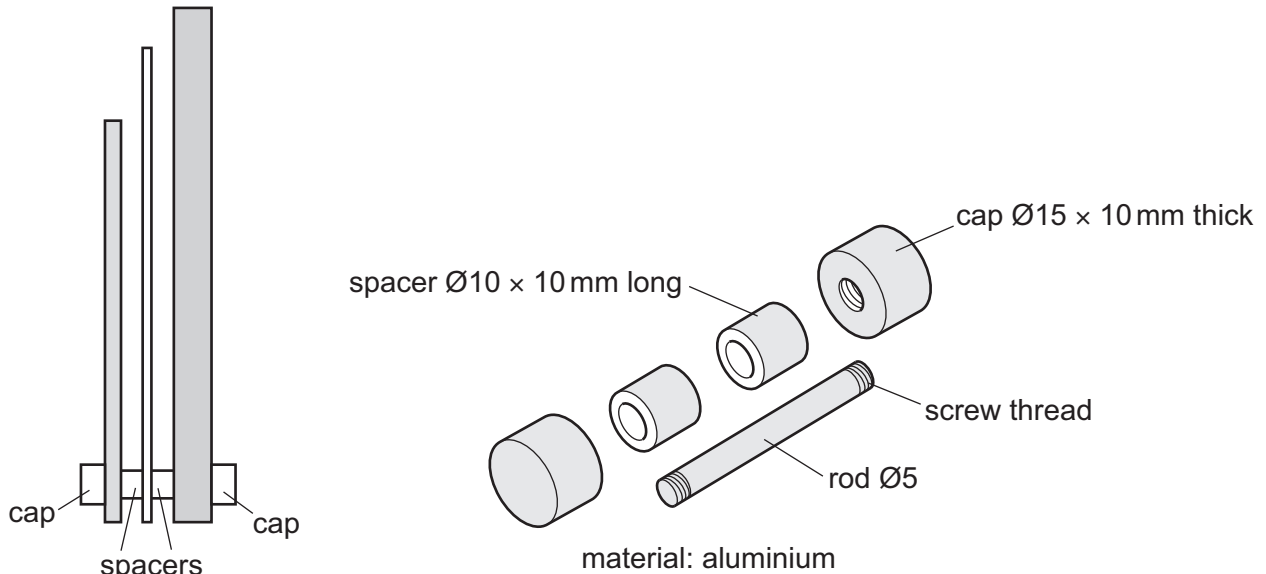


Fig. 11.3

Use sketches and notes to show how the $\varnothing 5$ screw thread could be cut **either** inside the cap **or** on the rod. Give details of all the tools and equipment used.





- (e) Describe, in detail, how the words 'D&T Award 2024' could be engraved into the surface of the acrylic using CAD/CAM.

.....

.....

.....

.....

.....

..... [4]

- (f) Use sketches and notes to show a design for a base onto which the trophy could be mounted. Give details of all materials and constructions used.

[4]

- (g) Explain why mahogany could be considered the most sustainable of the three materials used for the trophy.

.....

.....

..... [2]





12 Fig. 12.1 shows an incomplete design for a bird feeder made from 1.5 mm thick mild steel sheet.

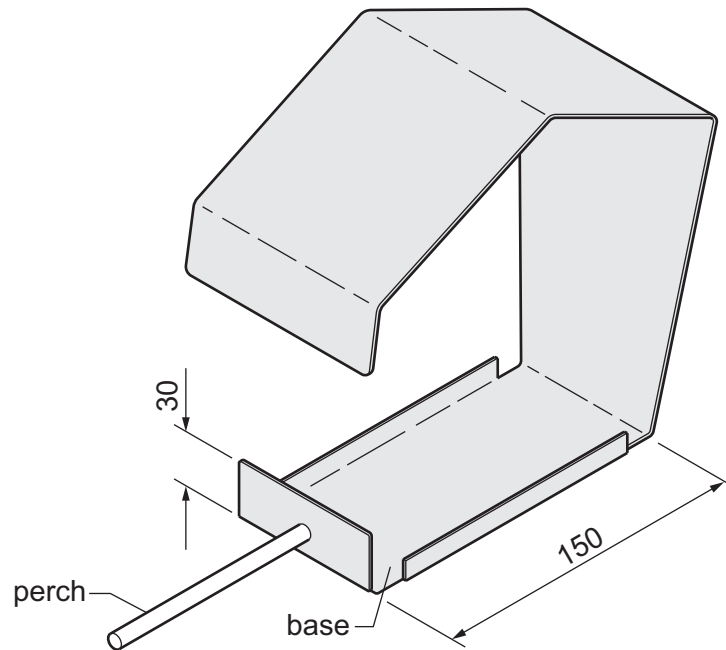


Fig. 12.1

- (a) Mild steel is a ferrous metal.
State what is meant by the term 'ferrous metal'.

..... [1]

- (b) Fig. 12.2 shows a screenshot of part of the bird feeder designed using CAD.

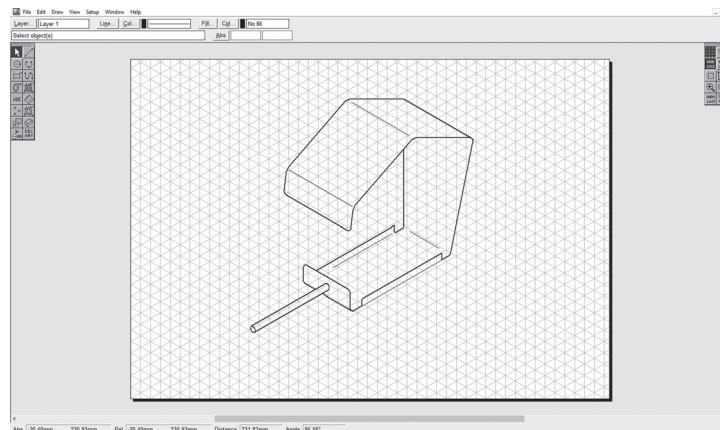


Fig. 12.2

State **two** advantages of on-screen modelling of the bird feeder rather than making a card model.

1

2

[2]





- (c) Fig. 12.3 shows the development (net) of the bird feeder marked out on 1.5 mm thick mild steel sheet.

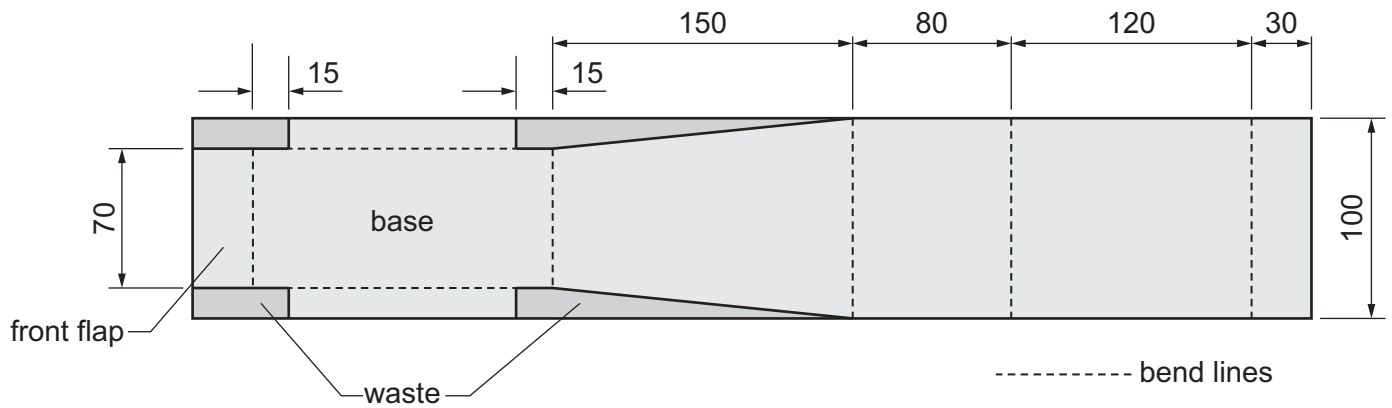


Fig. 12.3

- (i) Fig. 12.4 shows two tools, **A** and **B**, that could be used to cut out the waste metal.

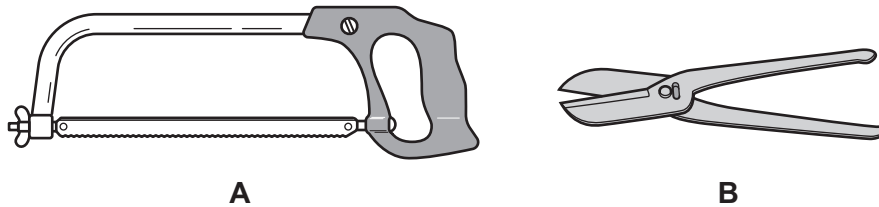


Fig. 12.4

Name tools **A** and **B**.

A

B

[2]

- (ii) Fig. 12.5 shows part of a guillotine that could also be used to cut sheet metal.

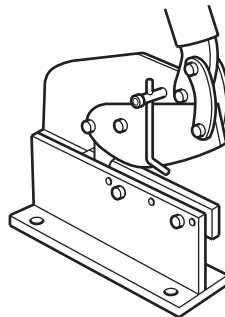


Fig. 12.5

Explain why the guillotine shown in Fig. 12.5 would only be partly successful in cutting out the waste metal in the development (net) of the bird feeder.

.....

 [2]





- (iii) Use sketches and notes to show how the development (net) could be bent to the shape of the bird feeder shown in Fig. 12.1.
Name all the tools and equipment used to produce the shape.

[5]

- (d) Fig. 12.6 shows the perch that will be joined to the bird feeder by means of a screw threaded mild steel rod and nut.
Fig. 12.7 shows the end of the mild steel rod before the screw thread is cut.

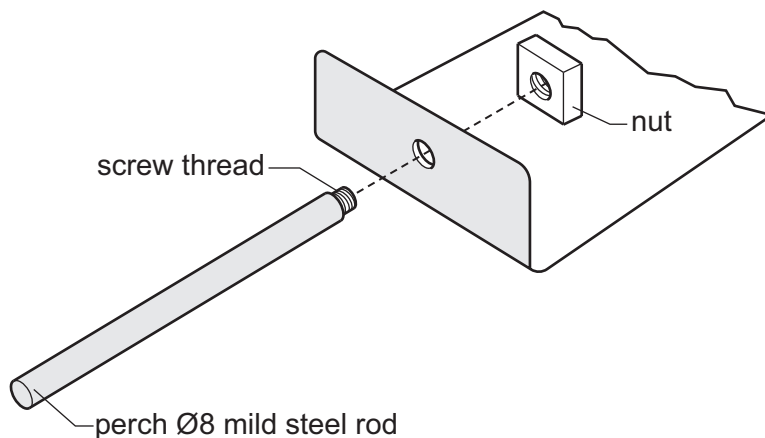


Fig. 12.6

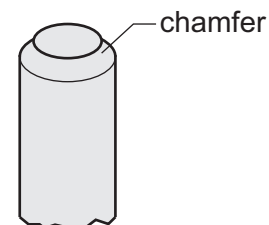


Fig. 12.7

- (i) State the purpose of the chamfer on the end of the Ø8 mild steel rod.

..... [1]

- (ii) State the purpose of applying cutting compound (grease) to the screw cutting tool.

..... [1]



- (e) Fig. 12.8 shows part of a $\text{Ø}25$ mild steel tube that will be fixed into the ground and joined to the base of the bird feeder.
Additional materials are needed to join the $\text{Ø}25$ mild steel tube permanently to the base of the bird feeder.

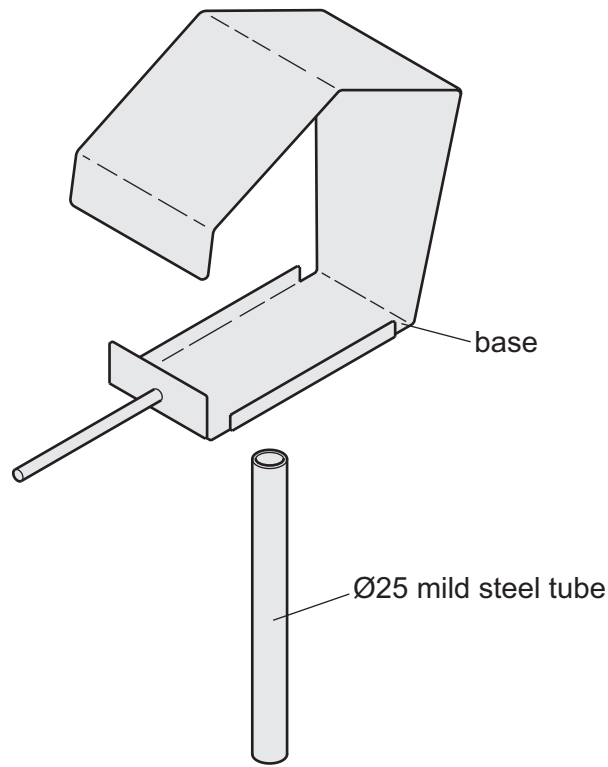


Fig. 12.8

Use sketches and notes to show how additional materials and constructions could be used to join the $\text{Ø}25$ mild steel tube permanently to the base of the bird feeder.





(f) Fig. 12.9 shows a plastic tray that will fit inside the base of the bird feeder.

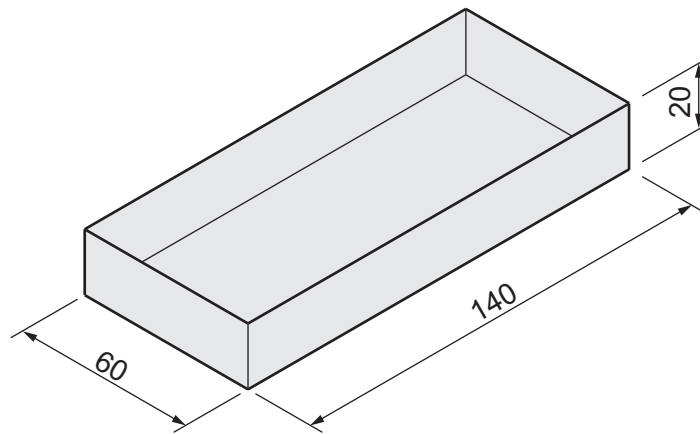


Fig. 12.9

Use sketches and notes to show how the plastic tray could be made.
Name the type of plastic used and show the method of construction.

[5]



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- 13 Fig. 13.1 shows a design for a stand for a hot melt glue gun. The stand is made from plywood and a batch of 12 stands will be produced in a school workshop.

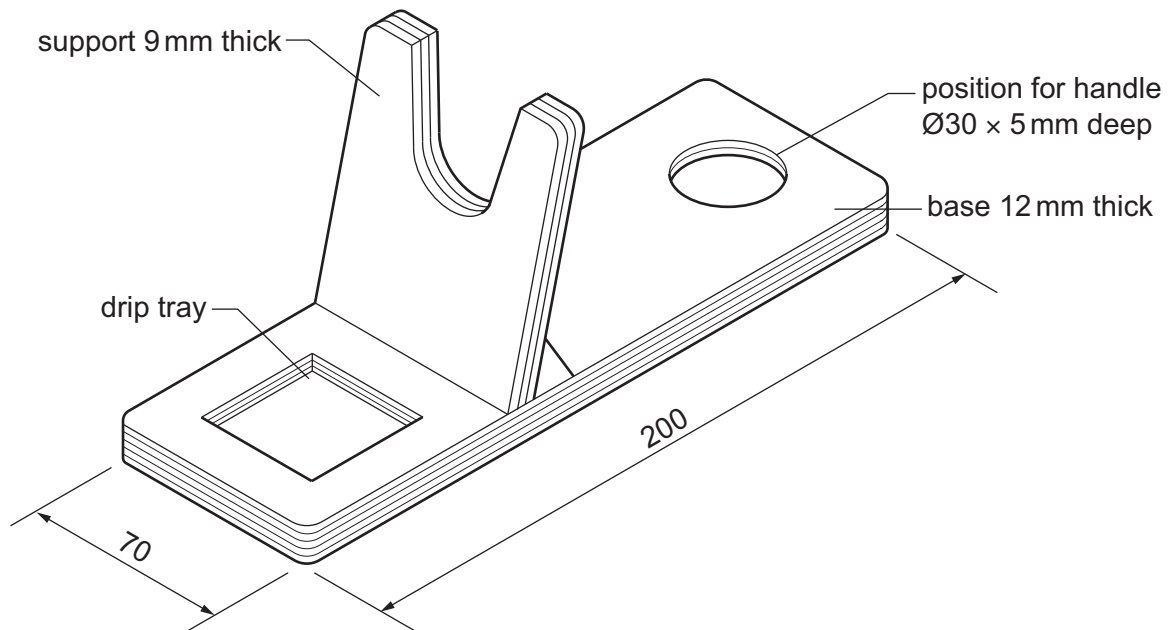


Fig. 13.1

- (a) State **two** specification points a designer would have considered when designing the hot melt glue gun stand.

1

2 [2]

- (b) (i) Plywood is a manufactured board.
Explain what is meant by the term 'manufactured board'.

.....

.....

..... [2]

- (ii) Name a different manufactured board that would be suitable for the glue gun stand.

..... [1]

- (iii) Give **two** advantages of making the glue gun stand from plywood rather than using hardwood.

1

2 [2]



- (c) Fig. 13.2 shows a drill bit that could be used to drill the $\text{Ø}30$ hole in the plywood base.



Fig. 13.2

- (i) Name the type of drill bit shown in Fig. 13.2.

..... [1]

- (ii) State **two** checks that should be made before switching on the drilling machine to drill the $\text{Ø}30$ hole in the plywood base.

1

2 [2]

- (d) Fig. 13.3 shows the waste that needs to be removed to produce the shape of the support.

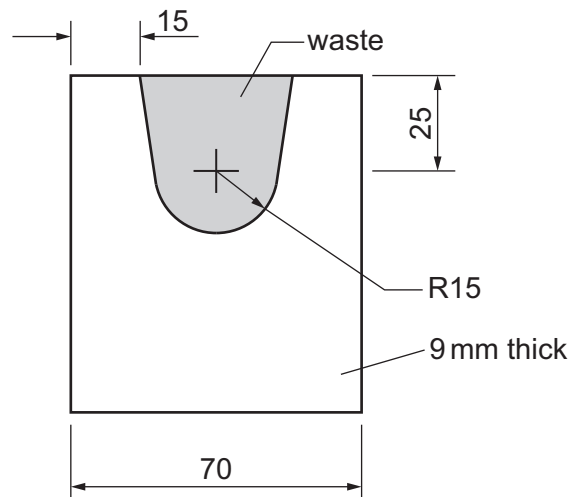


Fig. 13.3

Use sketches and notes to show how the waste could be removed to produce the shape.
Name all the tools and equipment used.





- (e) A batch of 12 stands will be made in a school workshop
 Fig. 13.4 shows details of the dowel joint used to join the support to the base of the glue gun stand.
 The support has been strengthened by a softwood block glued to the support.

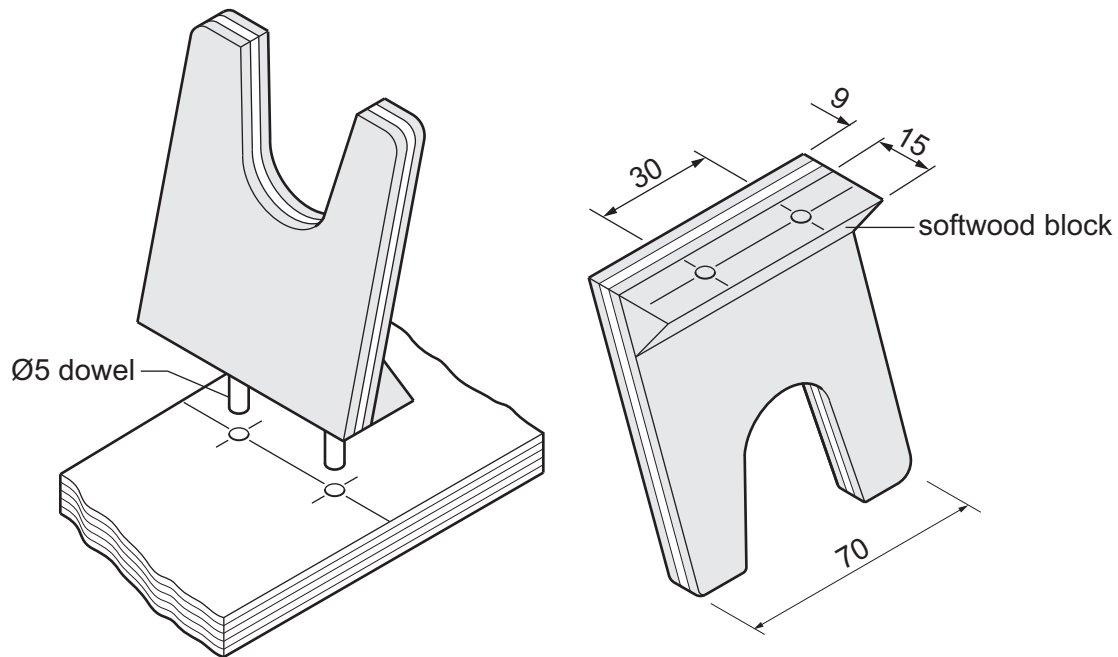


Fig. 13.4

- (i) Use sketches and notes to show how the holes for the dowels could be drilled accurately in the bases without the need for marking out.





- (ii) Fig. 13.5 shows part of a length of $\text{Ø}5$ dowel.
The dowels used for the joints are 15 mm long.

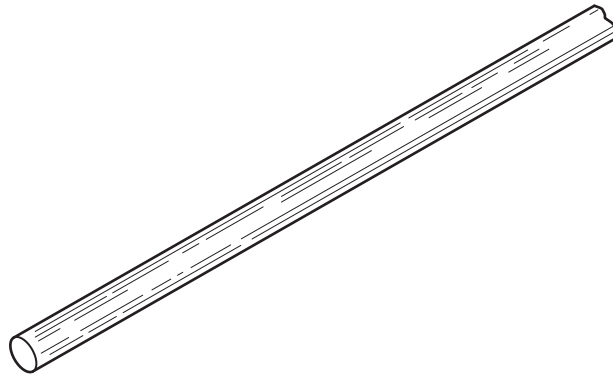


Fig. 13.5

Use sketches and notes to show a design for a sawing jig that could be used when cutting 15 mm lengths of dowel.

[3]





(f) Fig. 13.6 shows a glue stick used with a hot glue gun.

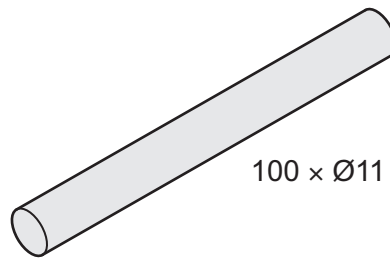


Fig. 13.6

Use sketches and notes to show a modification to the glue gun stand that would allow **five** spare glue sticks to be stored on the stand.
Give details of all materials and constructions used.

[4]



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