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## DESIGN &amp; TECHNOLOGY

0445/31

Paper 3 Resistant Materials

May/June 2026

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. Do **not** use correction fluid or tape.
- 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 **28** pages. Any blank pages are indicated.

Section A

Answer **all** questions in this section.

- 1 Figure 1.1 shows a toothbrush holder made from stainless steel.

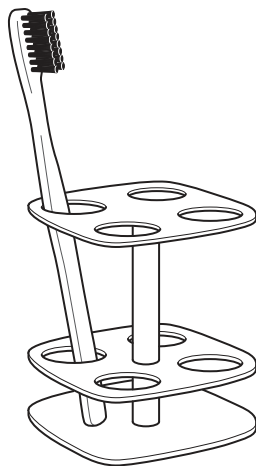


Figure 1.1

Give **two** specification points a designer would need to consider when designing the toothbrush holder.

The toothbrush holder must:

- 1 .....  
2 .....

[2]



- 2 Figure 2.1 shows an incomplete drawing of a mortise and tenon joint. Complete Figure 2.1 to show the tenon on part **A**.

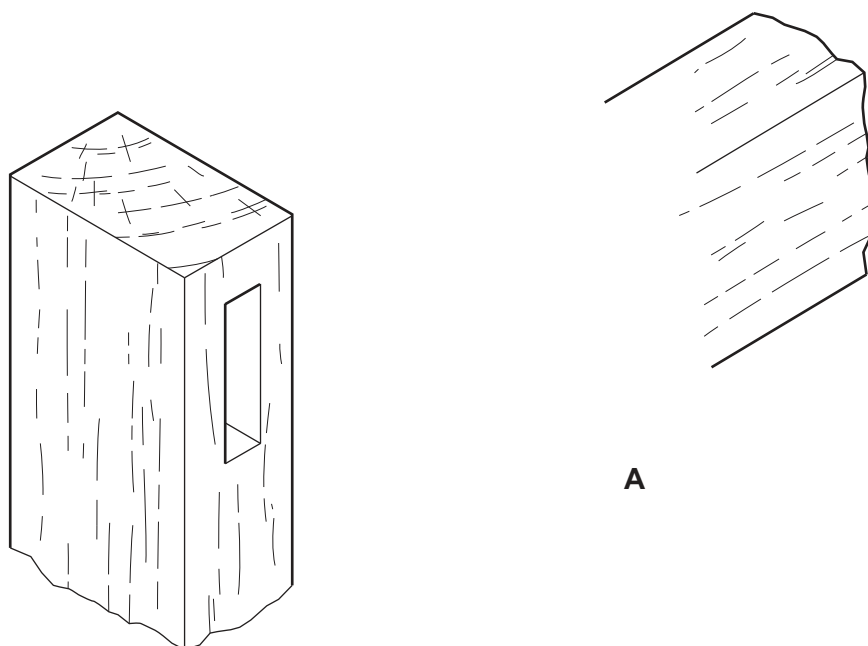


Figure 2.1

[3]

- 3 Figure 3.1 shows the outline details of a centre lathe.

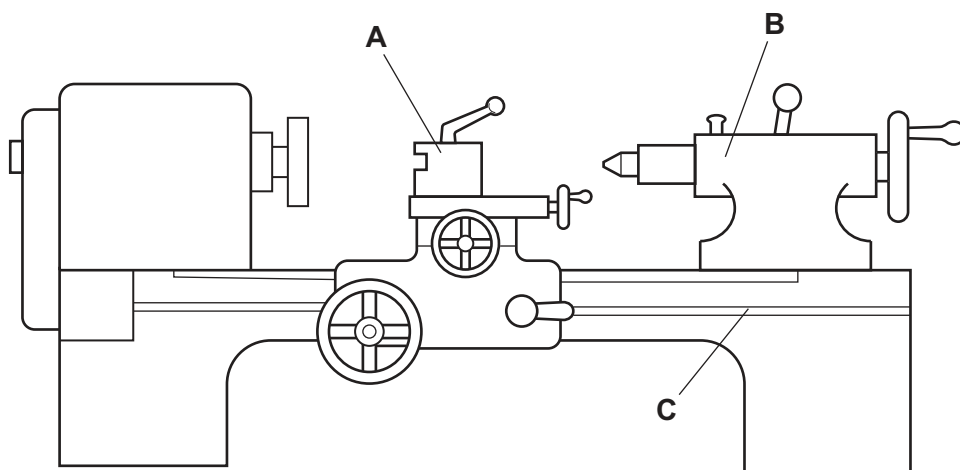


Figure 3.1

Select from the list the names of the **three** parts of the centre lathe, **A**, **B** and **C**.

lead screw      tailstock      bed      tool post      headstock

**A** .....

**B** .....

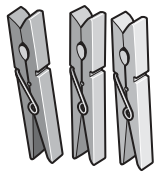
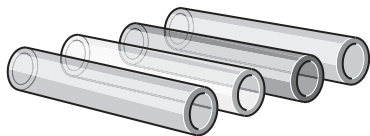
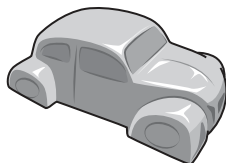
**C** .....

[3]

4 Table 4.1 shows three products made from plastic.

Complete Table 4.1 by giving the name of the manufacturing process used to make each product.

**Table 4.1**

| products                                                                                          | manufacturing process |
|---------------------------------------------------------------------------------------------------|-----------------------|
| <br>clothes pegs |                       |
| <br>tubes        |                       |
| <br>model car   |                       |

[3]



- 5 Figure 5.1 shows parts of two mild steel tubes that will be joined together by means of a Ø5 screw.

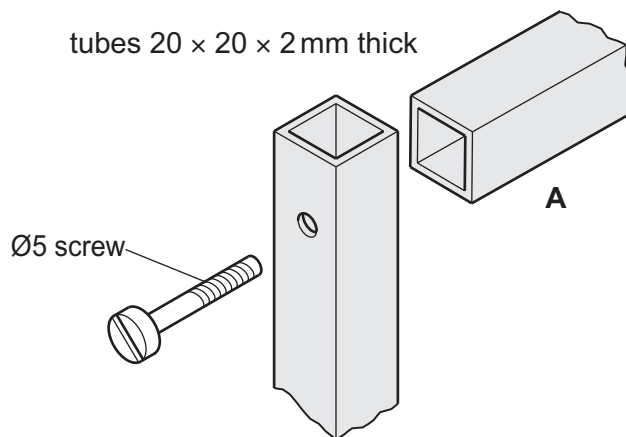


Figure 5.1

Use sketches and notes to show how the end of tube **A** could be modified so that the two tubes could be joined.

[2]

- 6 Figure 6.1 shows two floorboards joined together using a tongue and groove joint. The floorboards are made of softwood.

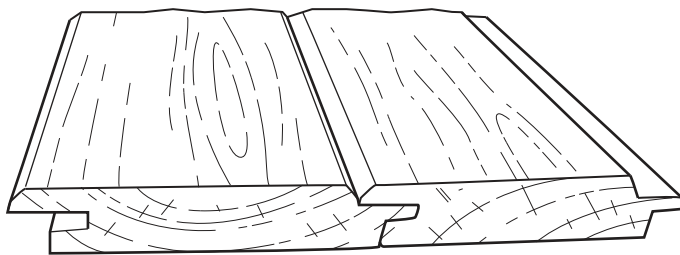


Figure 6.1

Explain why the softwood floorboards should **not** be glued together.

.....

.....

.....

[2]

7 **Circle** from the materials listed **one** material that is:

(a) biodegradable

**polystyrene**

**brass**

**pine**

**melamine**

**lead**

[1]

(b) from a sustainable source

**aluminium**

**polypropylene**

**tin**

**plywood**

**PVC**

[1]

8 Figure 8.1 shows part of a 400 mm length of hardwood with waste wood marked out. A plane will be used to remove the waste wood. The length of hardwood is too thin to be held in a vice while it is planed.

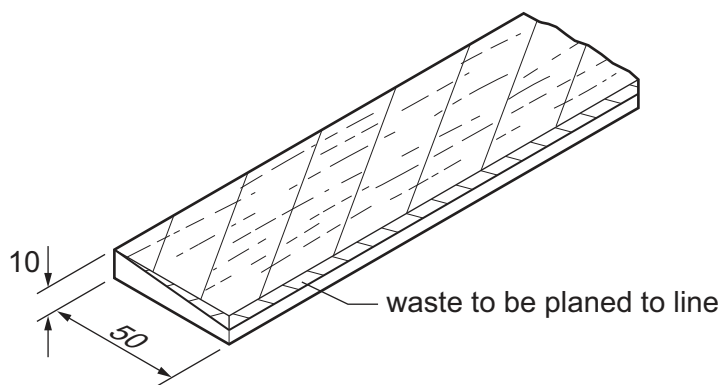


**Figure 8.1**

(a) Give the name of a plane that could be used to remove the waste wood.

..... plane [1]

(b) Use sketches and notes to show how the length of hardwood could be held securely while it is planed.

[2]





9 Figure 9.1 shows a gate made of softwood.

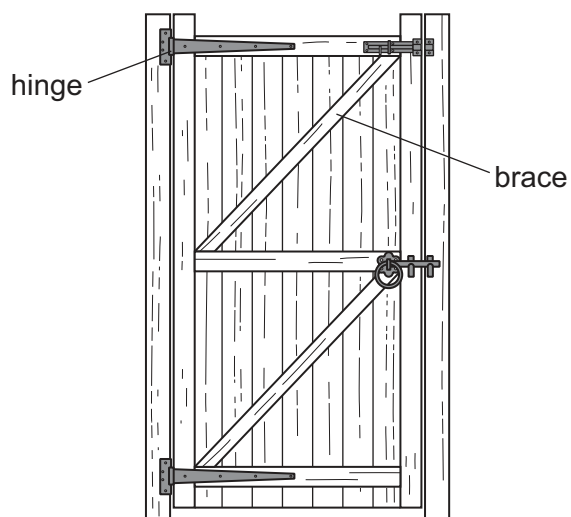


**Figure 9.1**

(a) Give the name of the type of hinge used.

..... hinge [1]

(b) State the purpose of the brace.

.....  
 ..... [1]



- 10 Figure 10.1 shows a handle made from 5 mm thick acrylic that will be fitted to the front of a small drawer, also made from 5 mm thick acrylic.

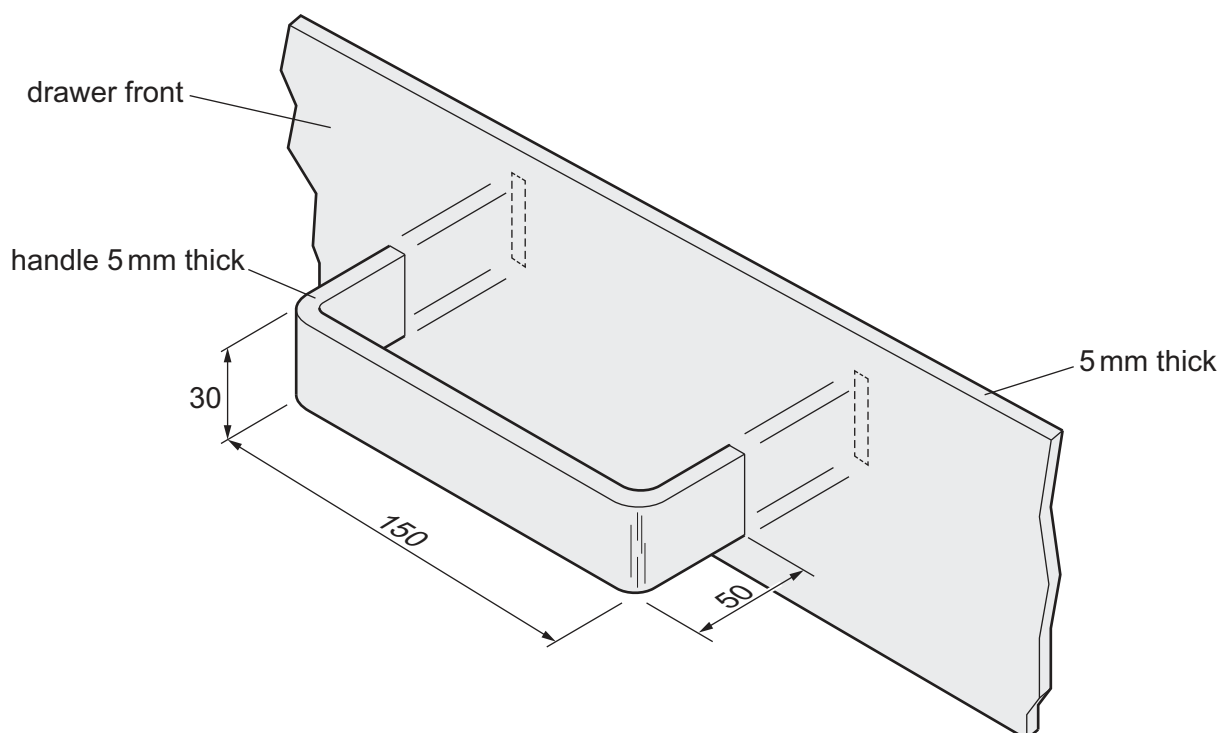


Figure 10.1

Use sketches and notes to show modifications to the handle and drawer front so the handle could be fitted securely to the drawer front **without** the use of an adhesive or additional fittings.

[3]

## Section B

Answer **one** question from this section.

- 11 Figure 11.1 shows details of a small table with a magazine rack. All the parts of the table are made from veneered MDF.

## Parts list

| part      | number required | length | x | width | x | thickness |
|-----------|-----------------|--------|---|-------|---|-----------|
| base      | 1               | 450    | x | 360   | x | 19        |
| table top | 1               | 450    | x | 360   | x | 19        |
| side      | 2               | 560    | x | 200   | x | 19        |
| shelf     | 4               | 340    | x | 210   | x | 9         |

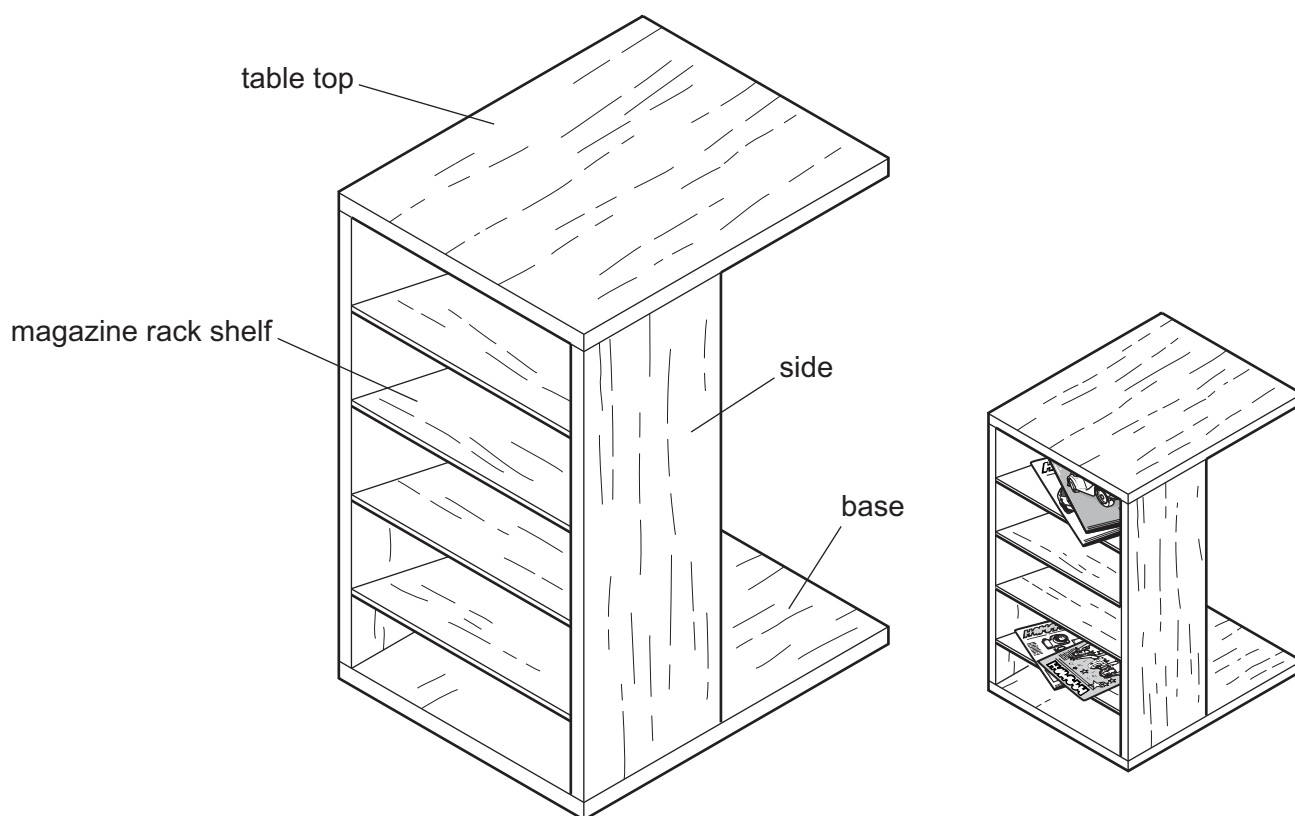


Figure 11.1

- (a) (i) The surfaces of the MDF are covered with a veneer.

State the purpose of a veneer.

..... [1]

- (ii) Give **one** drawback of furniture with veneered surfaces.

..... [1]

- (b) The sides of the table could be joined to the table top and base by means of knock-down (KD) fittings or dowel joints. Figure 11.2 shows part of one side and the base.

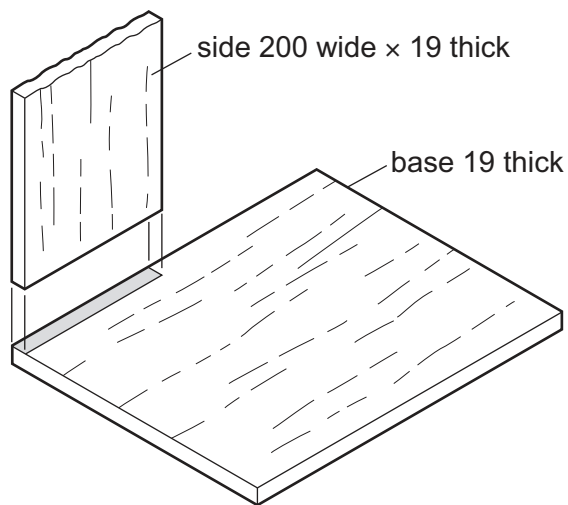


**Figure 11.2**

- (i) Sketch and name a knock-down (KD) fitting that could be used to join the side to the base of the table.

[3]

- (ii) Use sketches and notes to show how a dowel joint could be used to join the side to the base of the table. State the diameter of the dowels used.

[3]



- (c) The shelves for the magazines will be fitted into stopped housing joints.  
Figure 11.3 shows one side with stopped housing joints marked out, ready to be cut out.

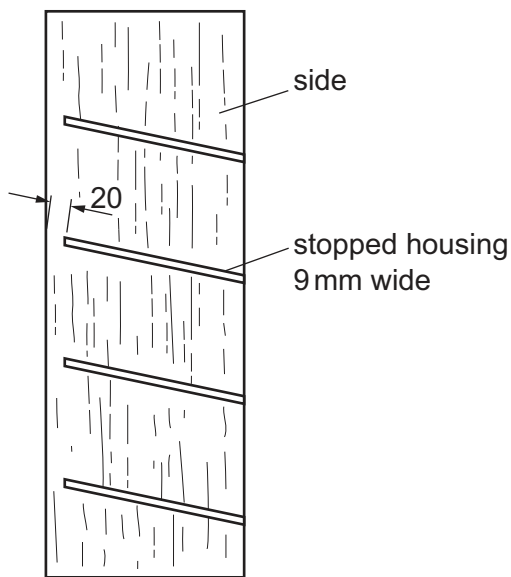


Figure 11.3

- (i) State **one** advantage of a stopped housing joint over a through housing joint.

..... [1]

- (ii) Figure 11.4 shows the corner of one shelf.

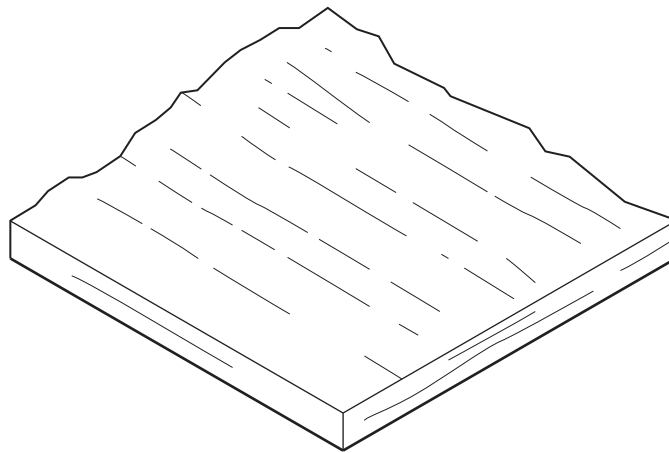


Figure 11.4

Draw on Figure 11.4 to show how the shelf would need to be modified to fit into the stopped housing. [2]

- (iii) The housings will be cut out using a power router.  
Give **two** safety precautions that must be taken when using portable power tools.

1 .....

2 .....

[2]



- (d) Figure 11.5 shows a palm sander that could be used to prepare the parts of the table before a finish is applied.

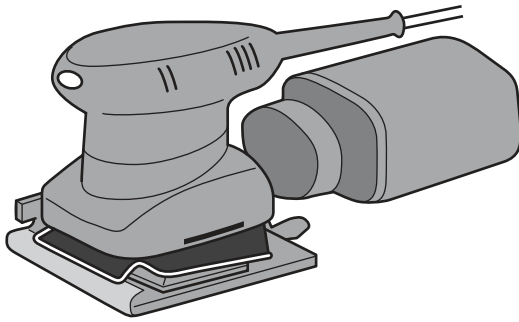


Figure 11.5

- (i) Give **two** benefits of using a palm sander to prepare the parts of the table.

1 .....

2 ..... [2]

- (ii) Explain why it would be necessary to use two different grades of glasspaper when using the palm sander to prepare the parts of the table.

.....

.....

..... [2]

- (iii) Name **two** appropriate clear finishes that could be applied to the parts of the table.

1 .....

2 ..... [2]



- (e) The table will be fitted with four 'feet' that will lift it 20 mm above the floor.

Use sketches and notes to show a design for **one** foot that could be fitted to the base of the table.

Include details showing how the foot could be joined to the base of the table.

[3]

(f) Figure 11.6 shows an inside view of the table and the magazine rack shelves.

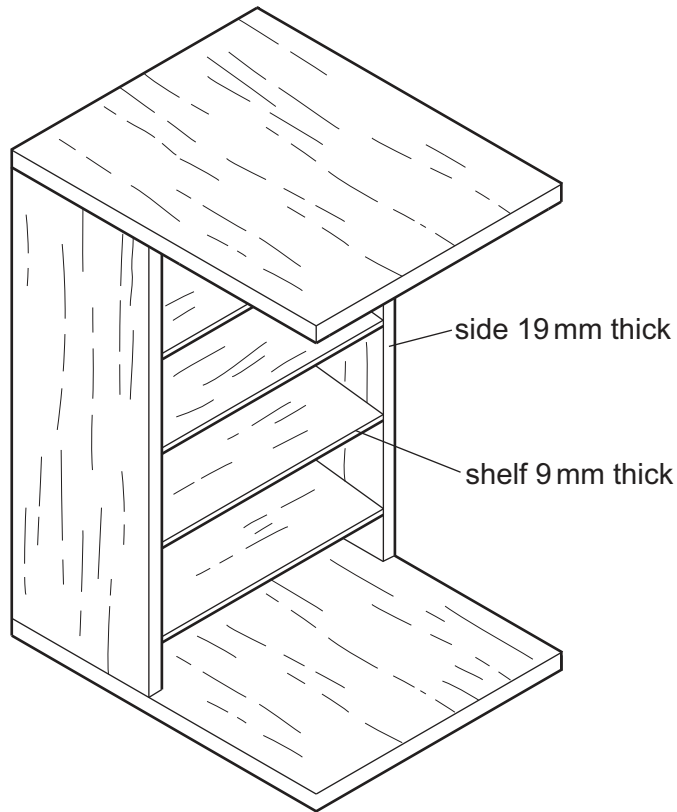


**Figure 11.6**

In use, the magazines will slide off the shelves.

Use sketches and notes to show a modification to prevent magazines from sliding off the shelves.

Give details of all materials and constructions.



- 12 Figure 12.1 shows a bird feeder that will be fitted on the top of a fence. Two plastic bowls fit into the base of the feeder.

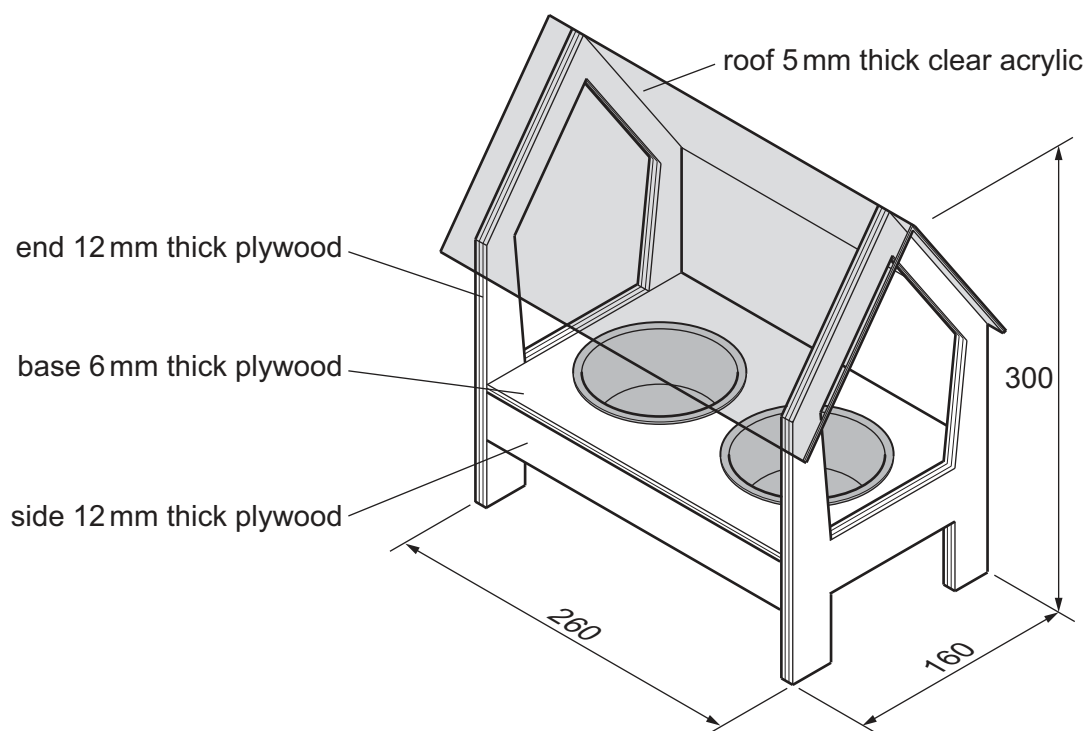


Figure 12.1

- (a) Give **two** advantages of using plywood rather than solid wood for parts of the feeder.

1 .....

2 .....

[2]



(b) Figure 12.2 shows one of the ends marked out, ready to be cut to shape.

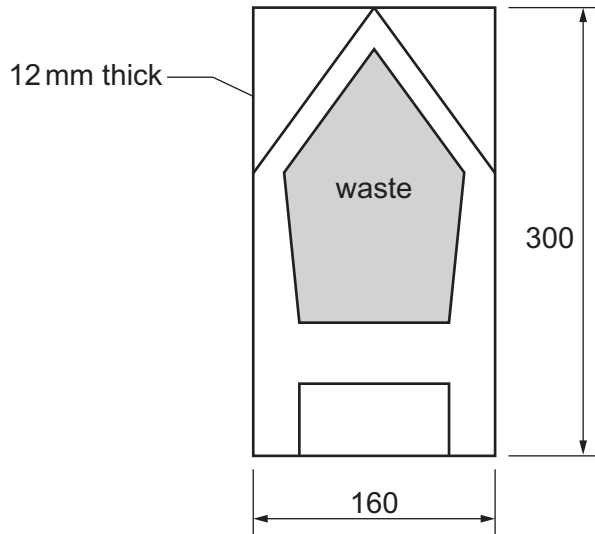


**Figure 12.2**

Use sketches and notes to show how the waste could be cut out by hand and the cut edges made flat and smooth.  
Name all the tools and equipment used.

[3]



- (c) Figure 12.3 shows where one end and one side of the bird feeder in Figure 12.1 will be joined together.

Add sketches and notes to Figure 12.3 to show how the side could be joined to the end. Name the joint used.

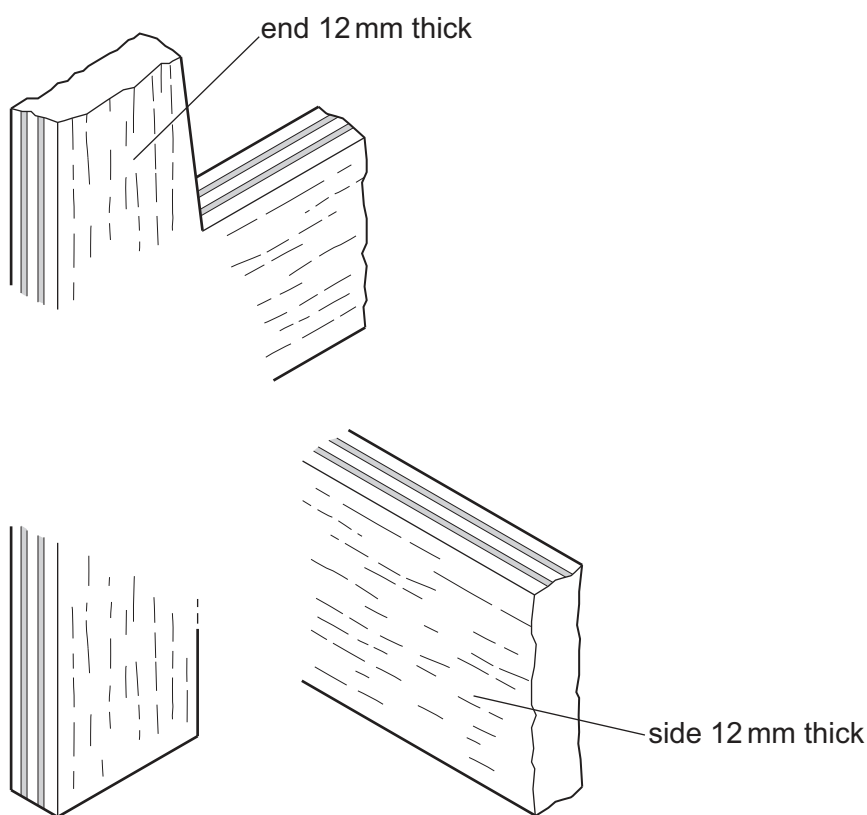


**Figure 12.3**

[4]

- (d) Figure 12.4 shows the base of the feeder.  
Two holes are needed for the plastic bowls to fit into.  
One hole has been cut out and a second hole is marked out, ready to be cut out.

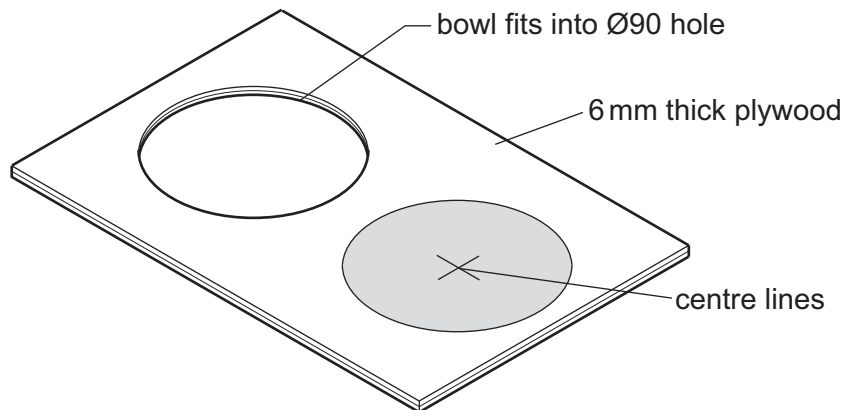


Figure 12.4

- (i) Name **two** tools that could be used to mark the centre lines on the base of the feeder.

1 .....

2 ..... [2]

- (ii) Give the name of the item of equipment shown in Figure 12.5 that could be used to cut a Ø90 hole in the plywood.

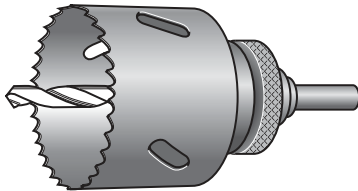


Figure 12.5

..... [1]



(e) Figure 12.6 shows the development (net) of the acrylic roof.

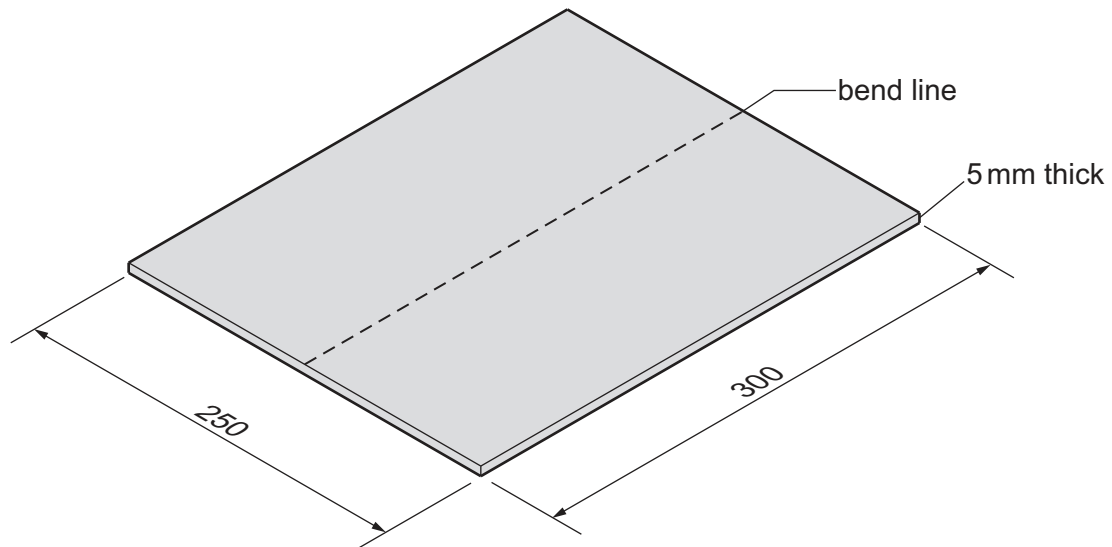


**Figure 12.6**

Use sketches and notes to show how the development (net) could be bent to the shape of the roof. Name all the tools and equipment used.

[4]

(f) The roof could be fixed to the ends of the bird feeder by means of wood screws. Give the following details of the wood screws that would be suitable to fix the roof to the ends of the bird feeder.

- the length of the screw .....
- the type of head .....
- the material from which the screw is made .....

[3]



- (g) The plastic bowls will be produced by vacuum forming.  
Figure 12.7 shows a cross-sectional view of a vacuum forming machine.  
The mould that is used is shown on the platen.

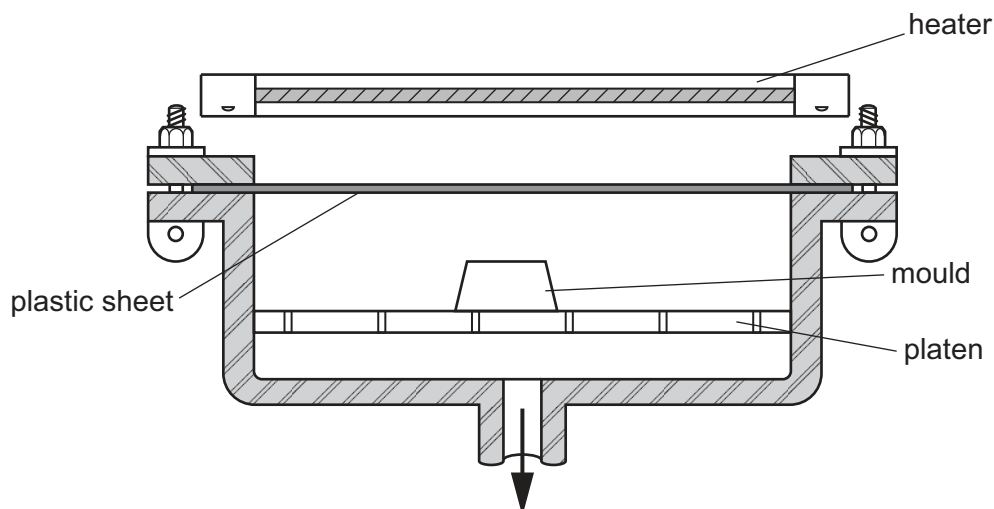


Figure 12.7

- (i) Name a suitable plastic that could be used to vacuum form the bowls.

..... [1]

- (ii) Explain why it is important to heat the plastic to the correct temperature when vacuum forming.

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

- (iii) Complete Table 12.1 by stating **three** additional stages when vacuum forming a bowl.

Table 12.1

| stages | vacuum forming process |
|--------|------------------------|
| 1      | switch on heater       |
| 2      |                        |
| 3      |                        |
| 4      |                        |

[3]



- 13 Figure 13.1 shows a design for a guitar stand. The leg and support are made from Ø8 mild steel rod and the mounts are laminated, using 1.5 mm thick hardwood veneers.

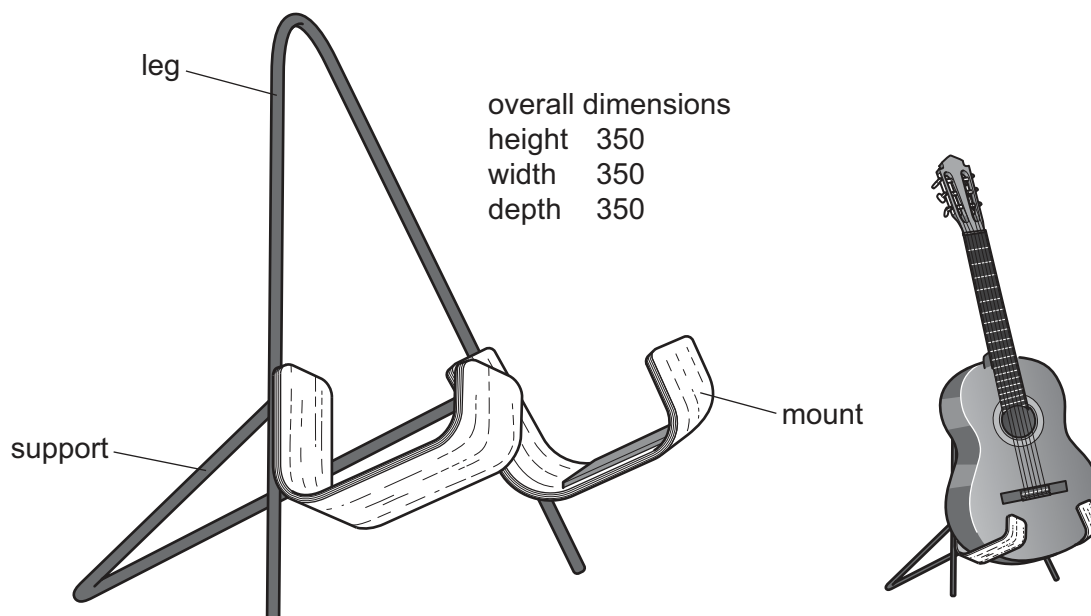


Figure 13.1

- (a) Give **two** items of research that the designer of the guitar stand would need to consider.

1 .....

2 ..... [2]

- (b) Give **two** benefits of using mild steel for parts of the guitar stand.

1 .....

2 ..... [2]

- (c) The leg is made from an 800 mm length of Ø8 mild steel rod. Part of the mild steel rod will be annealed before it can be bent to shape.

- (i) Give **one** reason why the mild steel rod would need to be annealed.

..... [1]

- (ii) Describe how the mild steel rod would be annealed.

.....

..... [2]



- (d) Figure 13.2 shows the leg of the guitar stand in position on a 20 mm thick wooden base after it has been bent to shape.

Draw on Figure 13.2 the positions of **three** metal pins that would have been used when bending the Ø8 mild steel rod to the shape of the leg.  
Give details of the metal pins used.

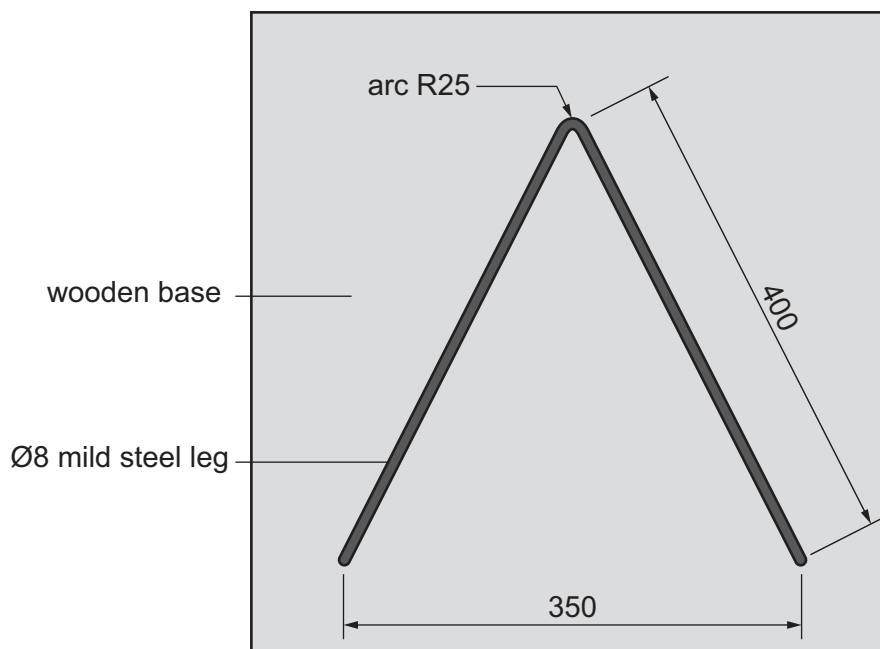


Figure 13.2

[4]

- (e) The support will be joined to the leg by the brazing process.  
Figure 13.3 shows three items of equipment or material used to braze the leg to the support.

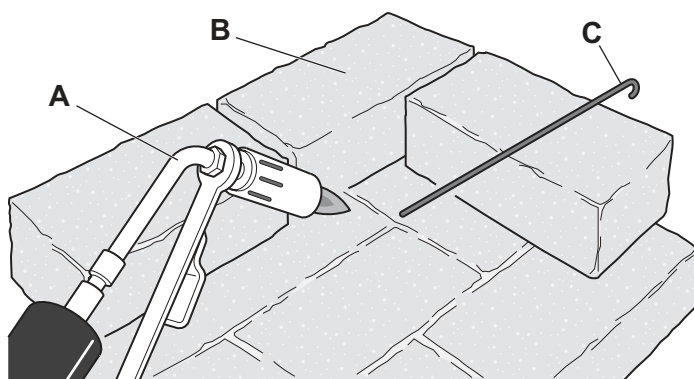


Figure 13.3

Name each item of equipment or material, **A**, **B** and **C**.

**A** .....

**B** .....

**C** .....

[3]



(f) The legs and support will be given a black painted finish.

(i) Name **two** abrasive papers that could be used to clean the mild steel rod before the paint is applied.

1 .....

2 .....

[2]

(ii) Name a different method, other than paint, of finishing the mild steel rod.

..... [1]

(g) Figure 13.4 shows four veneers that will be laminated to make one of the mounts for the guitar stand.

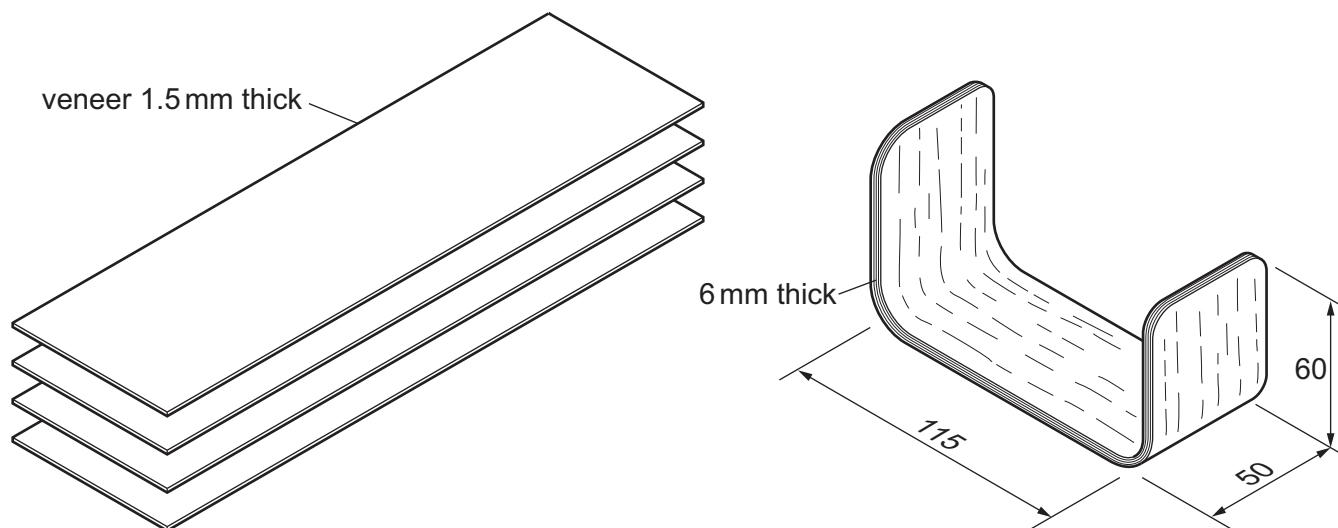


Figure 13.4

Use sketches and notes to show how the veneers could be laminated to make the shape of one of the mounts.

- (h) Figure 13.5 shows two areas of the guitar stand that need improvement.  
Area **A** could scratch the back of the guitar.  
Area **B** could damage the floor on which the guitar stand rests.

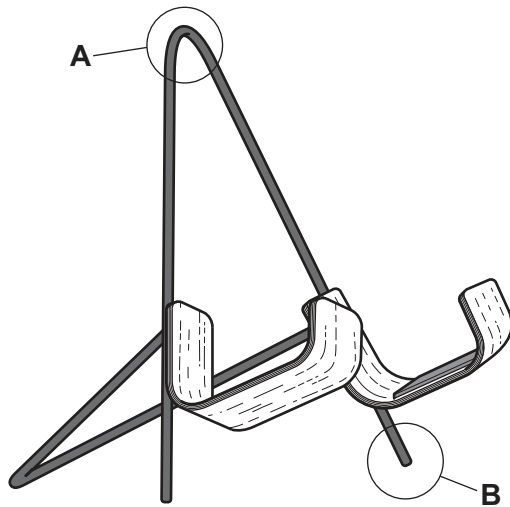


Figure 13.5

Use sketches and notes to show a modification to each area that would improve the design of the guitar stand.

Area **A**

[2]

Area **B**

[2]











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