



# Cambridge IGCSE™

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## DESIGN & TECHNOLOGY

0445/31

Paper 3 Resistant Materials

October/November 2021

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

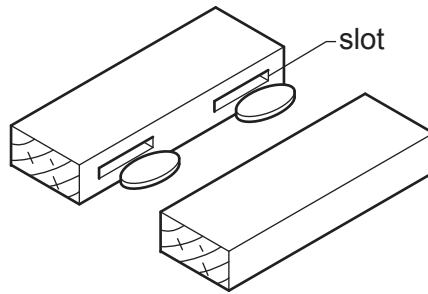
- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].
- All dimensions are in millimetres.

This document has **20** pages. Any blank pages are indicated.

**Section A**

Answer **all** questions in this section.

- 1 Fig. 1.1 shows a method of joining two lengths of hardwood. An adhesive is used.



**Fig. 1.1**

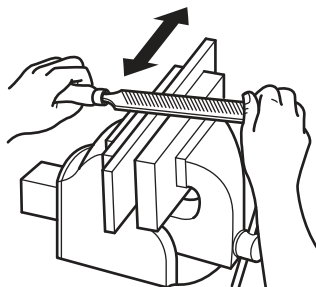
- (a) State the method of joining shown in Fig. 1.1.

..... [1]

- (b) State an alternative method of joining the two lengths of hardwood.

..... [1]

- 2 There are three main stages to be carried out to produce a high quality finish to the edges of acrylic sheet. Fig. 2.1 shows the first stage.



**Fig. 2.1**

- (a) Name the method of filing shown in Fig. 2.1.

..... [1]

- (b) After filing the edges, silicon carbide paper will be used.  
Give the common name for silicon carbide paper.

..... [1]

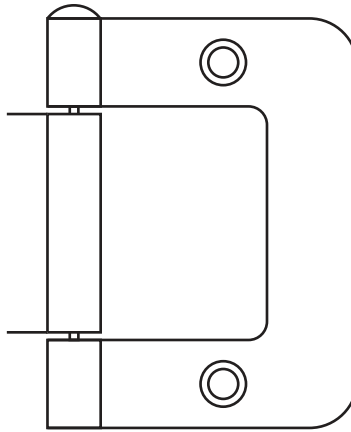
- (c) The third stage is to polish the edges on a buffing wheel.  
Give **two** safety precautions that must be taken when using a buffing wheel.

1 .....

2 .....

[2]

3 Fig. 3.1 shows an incomplete drawing of a flush hinge.



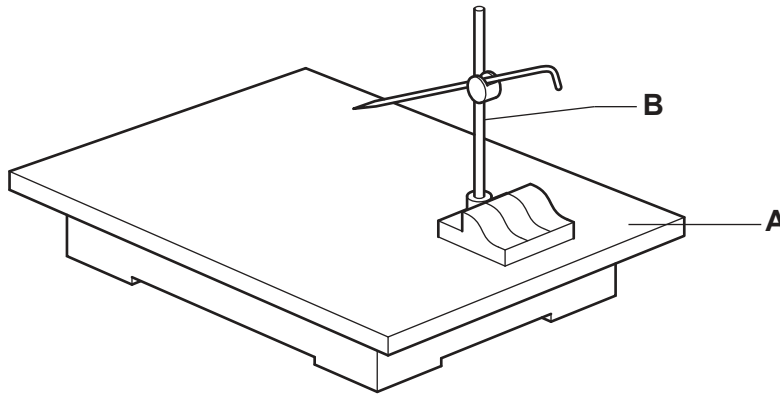
**Fig. 3.1**

Add to Fig. 3.1 to complete the drawing of the flush hinge. [2]

4 Circle from the list of materials below **one** material that can be anodised.

- copper      steel      lead      aluminium** [1]

5 Fig. 5.1 shows two items of equipment, **A** and **B**, used when marking out metal.



**Fig. 5.1**

Name the items of equipment **A** and **B** in Fig. 5.1.

**A** .....

**B** .....

[2]

- 6 Fig. 6.1 shows a chair.  
The curved parts of the chair have been produced by steam bending.



Fig. 6.1

Give **two** benefits of using steam bending to make the curved parts of the chair.

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

- 7 Fig. 7.1 shows a design for a wall-mounted leaflet holder.

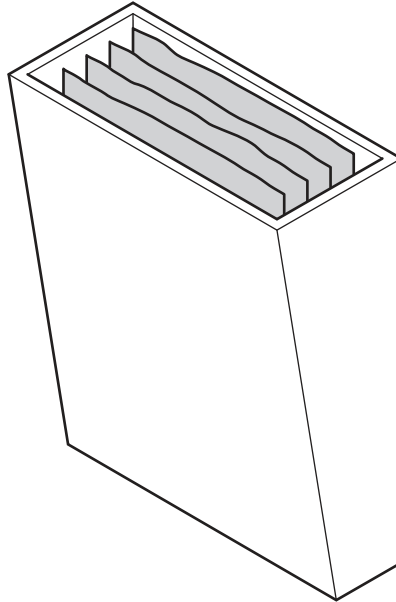


Fig. 7.1

Add sketches and notes to Fig. 7.1 to show a modification to the design that would make it easier to access the leaflets.

[2]

8 Fig. 8.1 shows a car body shell made from carbon fibre reinforced plastic (CFRP).

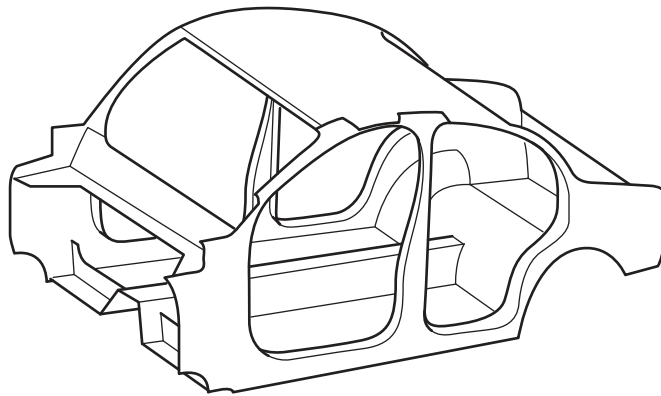


Fig. 8.1

Give **two** advantages of making the car body shell from carbon fibre reinforced plastic (CFRP) rather than mild steel.

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

9 Fig. 9.1 shows two serving trays.  
 Tray **A** is made from moulded thermosetting plastic.  
 Tray **B** is made from hardwood.

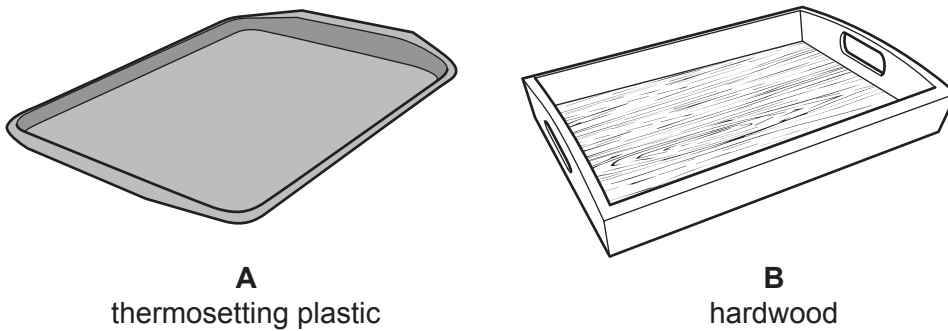


Fig. 9.1

(a) Name a suitable specific material for each tray.

- Tray **A** .....
  - Tray **B** .....
- [2]

(b) Give **two** reasons, other than cost, why consumers may prefer to purchase tray **A** rather than tray **B**.

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

10 Fig. 10.1 shows a plastic bottle and the symbol found underneath the bottle.

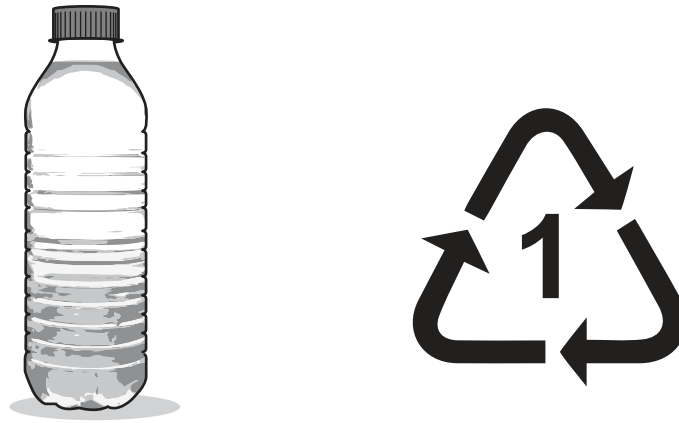


Fig. 10.1

(a) State the process used to mass produce the plastic bottle.

..... [1]

(b) Name the type of plastic used to make the bottle.

..... [1]

(c) Give **two** reasons why many products made from plastic are not recycled.

1 .....

2 .....

[2]

## Section B

Answer **one** question from this section.

- 11 Fig. 11.1 shows a child's rocking horse made from hardwood.

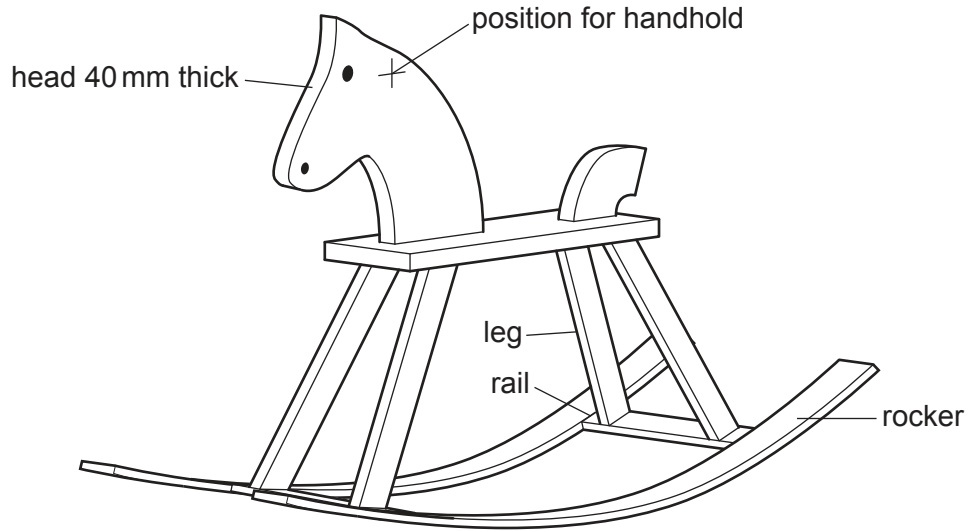


Fig. 11.1

- (a) Give **two** properties of hardwood that make it suitable for the rocking horse.

1 .....

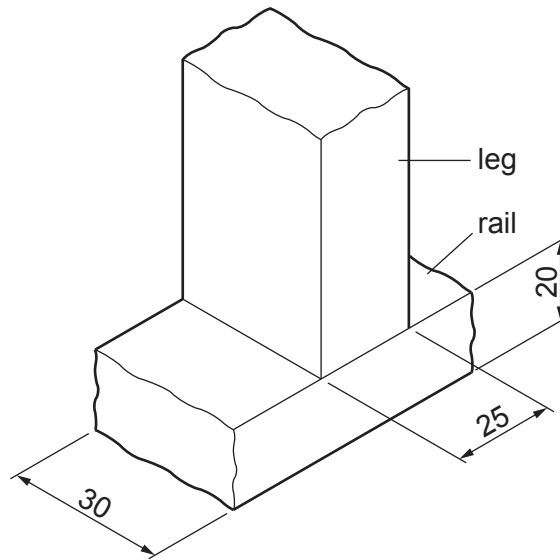
2 .....

[2]

- (b) The position for a handhold is shown in Fig. 11.1.  
Use sketches and notes to show a design for a comfortable handhold and a method of fitting it to the rocking horse.

[3]

(c) Fig. 11.2 shows part of one leg and the rail to which it is joined.



**Fig. 11.2**

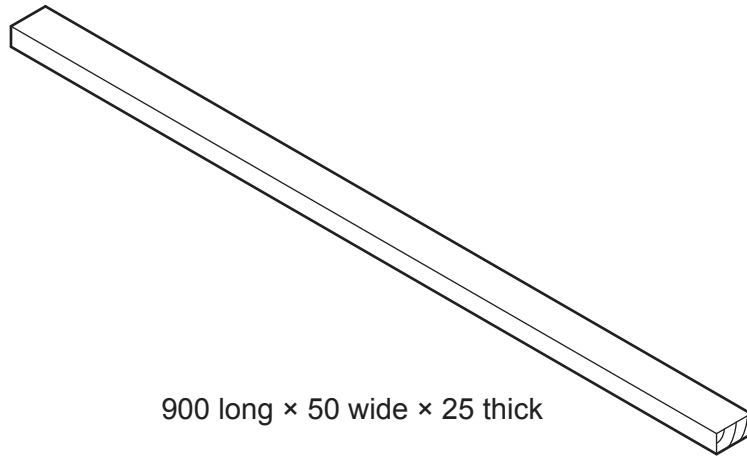
Sketch and name a suitable joint that could be used to join the leg to the rail.

Name of joint.....

[4]



(d) Fig. 11.3 shows a length of hardwood that will be steam bent to make the rocker.



**Fig. 11.3**

Use sketches and notes to show the main processes used to produce the shape of the rocker.

[5]

(e) Explain how the designer has considered anthropometric data when designing the rocking horse.

.....

.....

.....

..... [3]

(f) Fig. 11.4 shows a different design of rocking horse made from plastic.

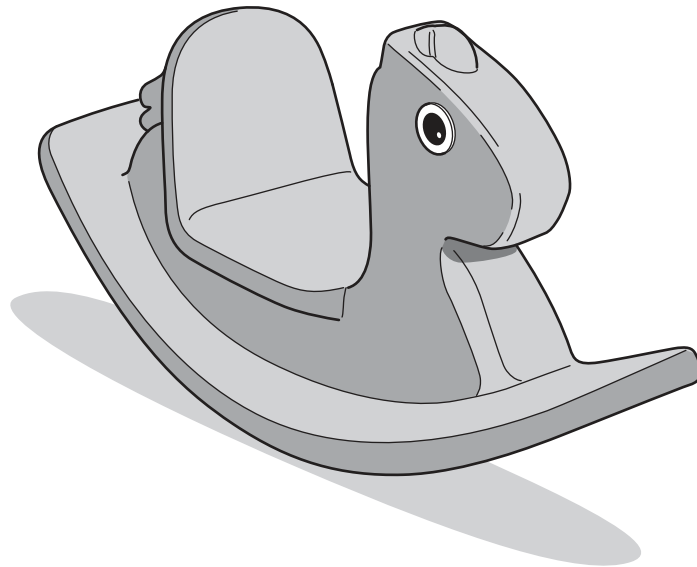


Fig. 11.4

(i) Describe **two** ways in which the plastic rocking horse could be considered safer for children to use than the rocking horse made from hardwood.

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

[4]

(ii) Both rocking horses are batch produced in quantity. Give **two** detailed reasons why the hardwood rocking horse would be more expensive to batch produce than the rocking horse made from plastic.

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

[4]

- 12 Fig. 12.1 shows an incomplete design for a desk tidy.  
The trays are made from vacuum formed plastic and can rotate as shown.

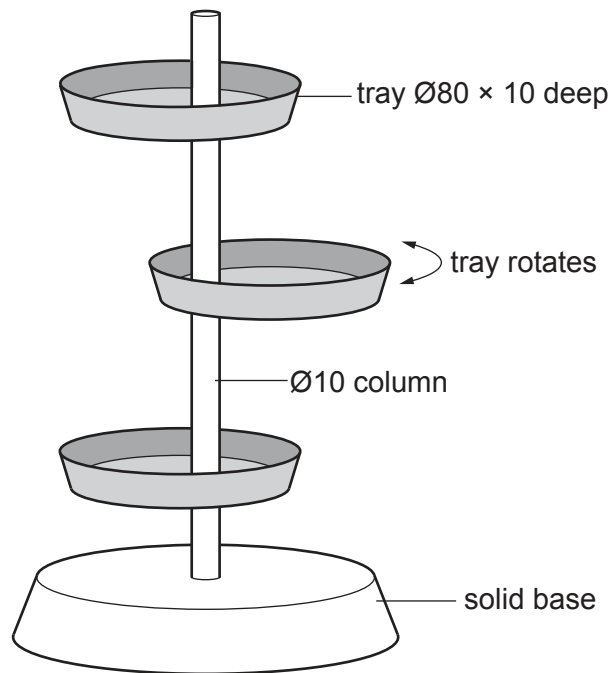


Fig. 12.1

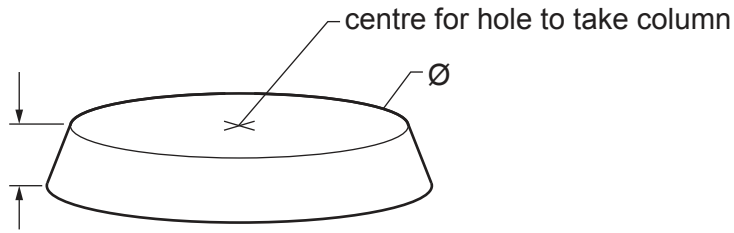
- (a) Name a suitable plastic for the trays.

..... [1]

- (b) Use sketches and notes to show how **one** tray could be vacuum formed.

[6]

(c) Fig. 12.2 shows the solid base for the desk tidy.



**Fig. 12.2**

(i) Name a suitable material for the solid base.

..... [1]

(ii) Give **one** reason for your choice of material.

..... [1]

(iii) Add **two** dimensions to Fig. 12.2 to show a suitable thickness and diameter for the solid base. [2]

(iv) Use sketches and notes to show how the solid base shown in Fig. 12.2 could be produced in a school workshop.

[5]

- (v) Name a suitable material for the Ø10 column and use sketches and notes to show how the column could be joined securely to the solid base.

[3]

- (d) Use sketches and notes to show how the trays could be supported on the column and allowed to rotate freely as shown in Fig. 12.1.

[4]

- (e) The trays could be replaced with lids from used containers that would otherwise be thrown away. Fig. 12.3 shows a variety of lids.

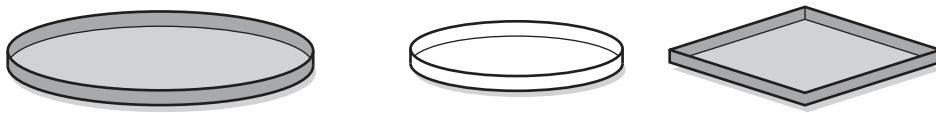


Fig. 12.3

Give **two** benefits of reusing items that would otherwise be thrown away.

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

[2]

13 Fig. 13.1 shows details of a 'floating' shelf.

- The shelf bracket is screwed to the wall.
- The shelf slides onto the bracket, hiding it from view.
- The shelf appears to be 'floating' because there is no visible means of support.

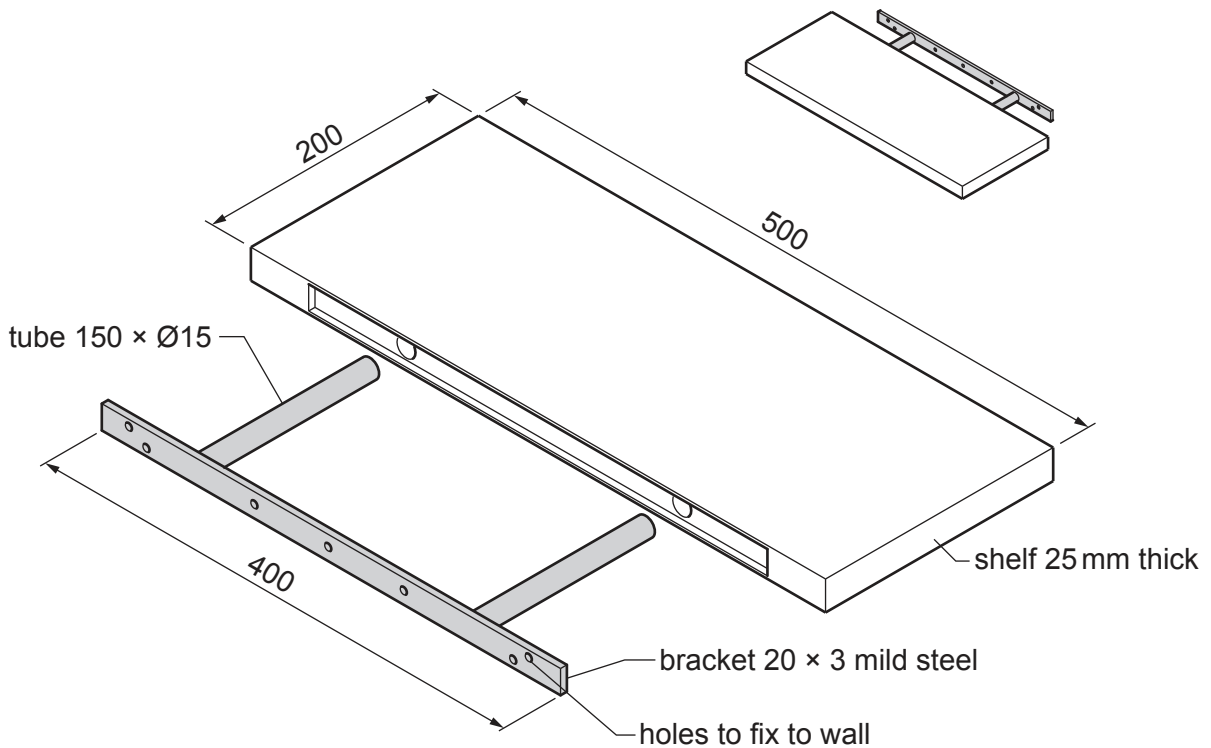


Fig. 13.1

(a) (i) Give **one** advantage of using a manufactured board for the shelf rather than solid wood.

..... [1]

(ii) Give **one** advantage of using MDF rather than plywood for the shelf.

..... [1]

(b) Fig. 13.2 shows part of the mild steel bracket with the centres marked out for two holes to be drilled.

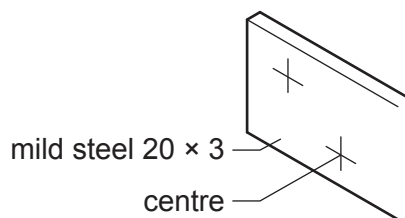


Fig. 13.2

(i) Name **one** tool that could be used to mark the lines on the surface of the mild steel bracket.

..... [1]

(ii) Give **one** reason why it is important to use a centre punch before drilling holes in the mild steel bracket.

..... [1]

(c) Fig. 13.3 shows part of the back of the shelf.  
A recess has been cut out to take the mild steel bracket.  
A power router could be used to cut out most of the recess.

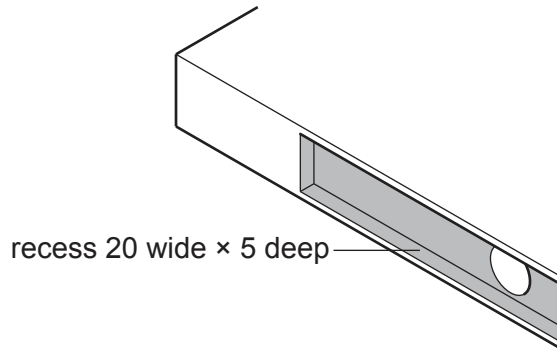


Fig. 13.3

State **two** checks that must be made before using the power router to cut out the recess.

1 .....

2 .....

[2]

(d) Fig. 13.4 shows one tube that will be joined to the bracket by means of brazing.

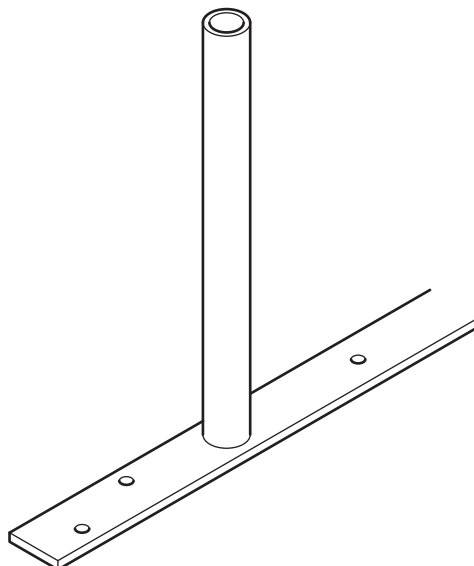


Fig. 13.4

(i) Add to Fig. 13.4 to show how the position of the tube could be checked to make sure it is vertical. Name the tools or equipment used. [3]

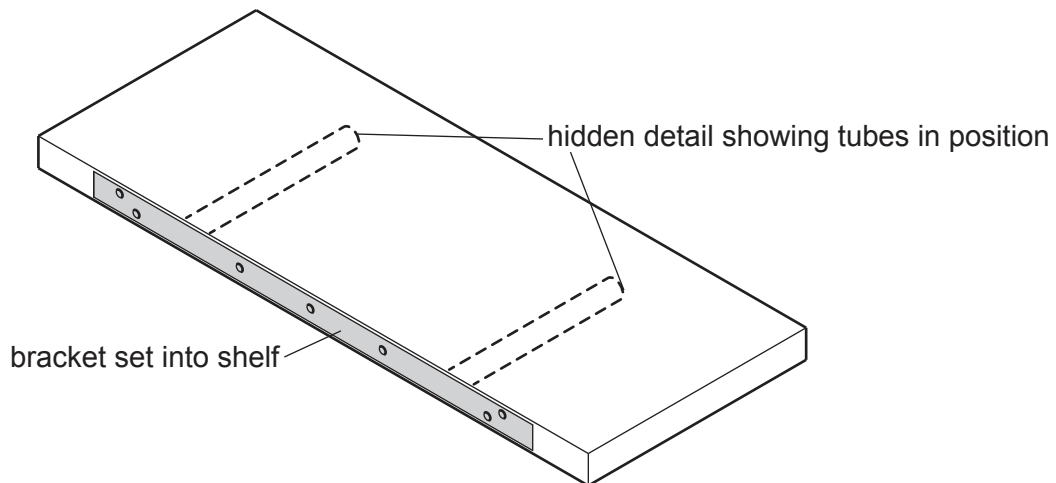
- (ii) Complete Table 13.1 by describing how each of the materials or items of equipment could be used when brazing the tube to the bracket.

**Table 13.1**

Material/item of equipment	Use
emery cloth	
flux	
blow torch	
brazing rod	

[4]

- (e) Fig. 13.5 shows the position of the two tubes inside the shelf when the bracket is screwed to a wall. In use, there is nothing to prevent the shelf from sliding off the tubes.



**Fig. 13.5**

Use sketches and notes to show how the shelf could be secured to the tubes to prevent the shelf from sliding off.

The method of securing the shelf must:

- not be visible when the shelf is on a wall
- be able to be removed.

Include details of fittings and fixings used.

[4]



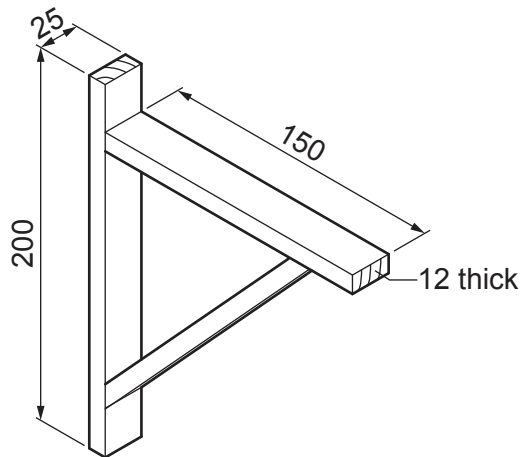
(f) The MDF shelf will have a painted finish.  
Give **two** reasons why consumers may prefer a painted finish rather than a clear lacquered finish.

1 .....

2 .....

[2]

(g) Fig. 13.6 shows a different type of shelf bracket made from hardwood.



**Fig. 13.6**

Use sketches and notes to show how the bracket could be constructed from a 600 mm length of hardwood.

Show details of:

- marking out
- cutting and shaping
- joining.

[6]





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