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0445/33

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

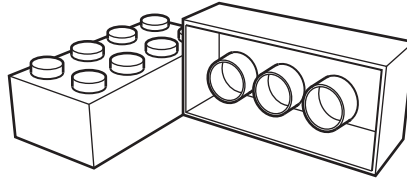
- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].
- All dimensions are in millimetres.

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

Section A

Answer **all** questions in this section.

- 1 Fig. 1.1 shows building blocks used in a children's construction set. The building blocks are made from a thermoplastic.



blocks $50 \times 25 \times 20$

Fig. 1.1

- (a) Name a suitable thermoplastic for the building blocks.

..... [1]

- (b) State **two** specification points a designer would need to consider when designing building blocks for young children.

1

2 [2]

- 2 Fig. 2.1 shows two pieces of softwood that will be joined using panel pins.

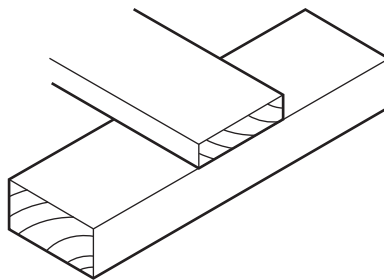


Fig. 2.1

- (a) Add sketches to Fig. 2.1 to show how the two pieces of softwood could be joined by means of 'staggered' nailing.

[2]

- (b) Name a tool that could be used to sink the panel pins below the surface of the wood.

..... [1]

3 Fig. 3.1 shows a workshop process.

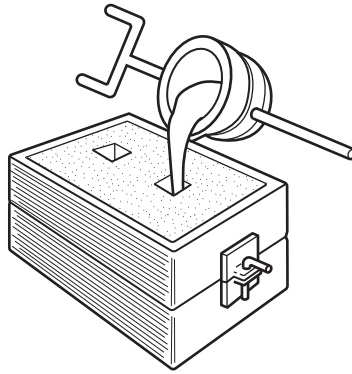


Fig. 3.1

(a) Name the process shown in Fig. 3.1.

..... [1]

(b) State **one** item of Personal Protective Equipment (PPE), other than face protection, that must be worn when carrying out the process shown in Fig. 3.1.

..... [1]

4 Fig. 4.1 shows two measuring tools, **A** and **B**, that can be used with round section materials.

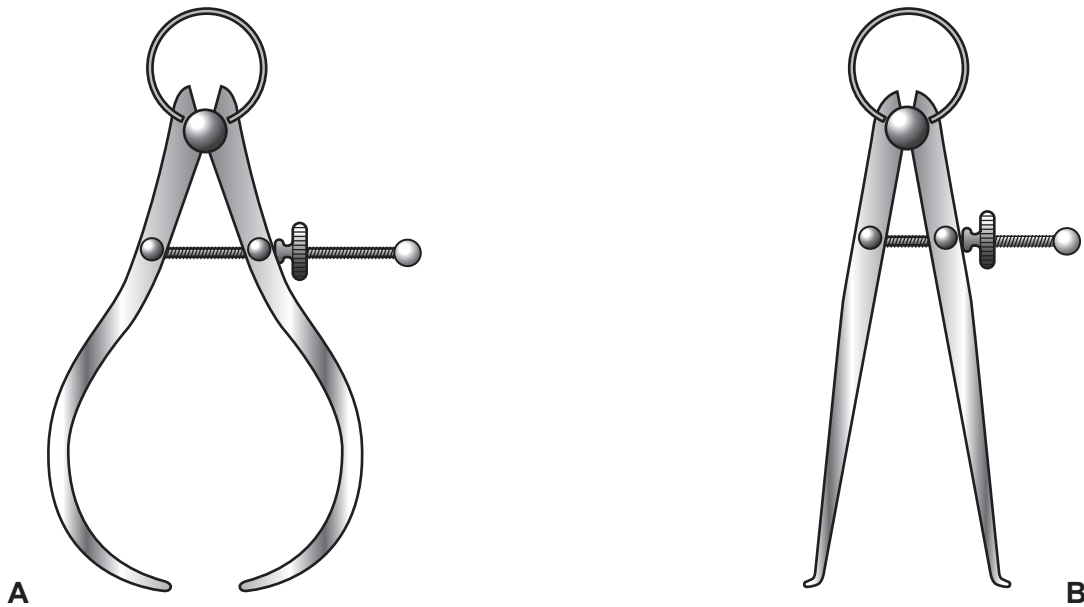


Fig. 4.1

Add sketches and notes to Fig. 4.1 to show how the tools, **A** and **B**, could be used.

[4]

- 5 Complete the sentence below by adding the correct term from the list.

construction

user

packaging

cost

Ergonomics is the term given to describe the relationship between a product and its

..... [1]

- 6 Fig. 6.1 shows a cabinet door. The door has a panel that is fitted inside the hardwood frame.

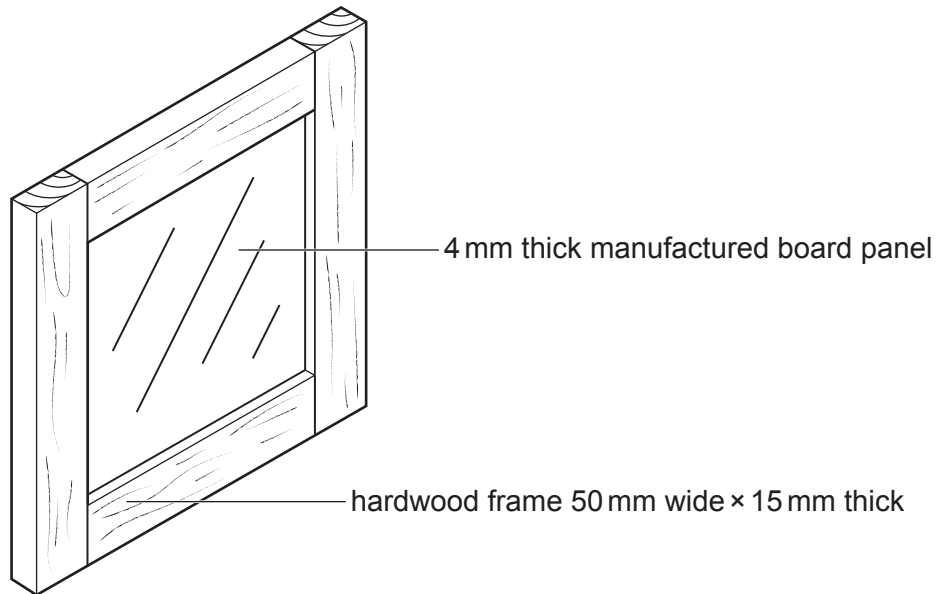


Fig. 6.1

Use sketches and notes to show how the panel could be fitted **inside** the hardwood frame of the cabinet door.

[3]

- 7 Fig. 7.1 shows two pieces of hardwood, **A** and **B**, set up, ready to be 'turned' on a woodturning lathe.

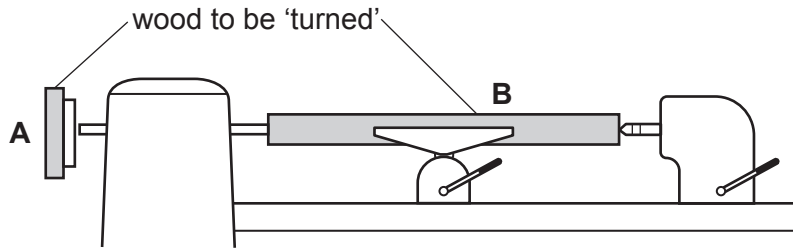


Fig. 7.1

Name the woodturning processes to be carried out on the hardwoods **A** and **B**.

Process for **A**

Process for **B**

[2]

- 8 Fig. 8.1 shows a cycle helmet.



Fig. 8.1

A list of plastics is given below.

nylon polycarbonate polypropylene expanded polystyrene acrylic

- (a) Select from the list **one** plastic that is suitable for the outer shell.

..... [1]

- (b) Select from the list **one** plastic that is suitable for the inner lining.

..... [1]

- 9 A list of metals is given below.

cast iron

aluminium

stainless steel

duralumin

copper

Select from the list **one** metal that is a:

(a) ferrous alloy [1]

(b) non-ferrous alloy. [1]

- 10 Fig. 10.1 shows details of a cross head water tap.

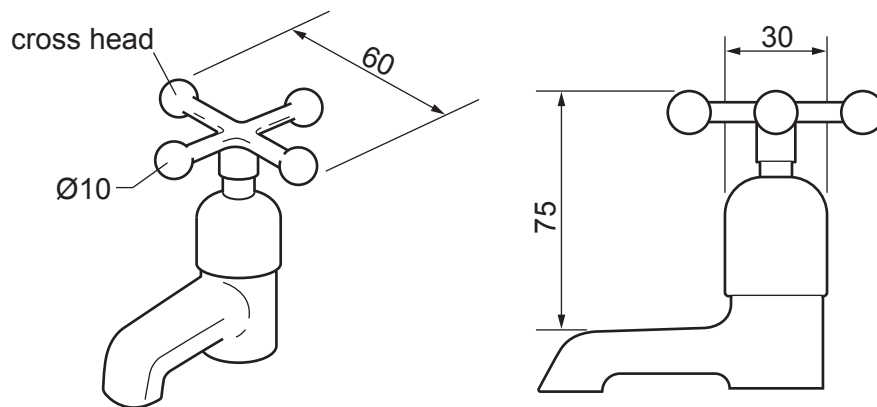


Fig. 10.1

Use sketches and notes to show a design for a device that would make it easier for people with poor grip to turn the tap on or off.

The device must fit **either** over, under or across the cross head of the water tap.

Section B

Answer **one** question from this section.

- 11 Fig. 11.1 shows an incomplete design for a table top organiser made from acrylic. The organiser is made up of six identical containers that will be joined together.

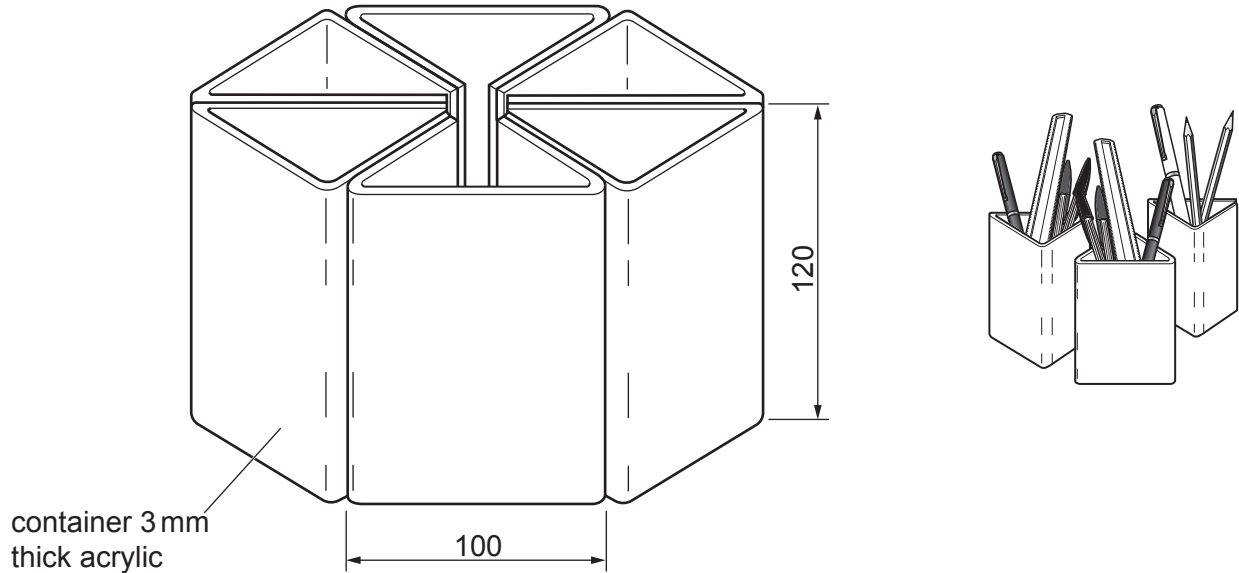


Fig. 11.1

- (a) Fig. 11.2 shows a screenshot of the development (net) of one of the containers produced using CAD.

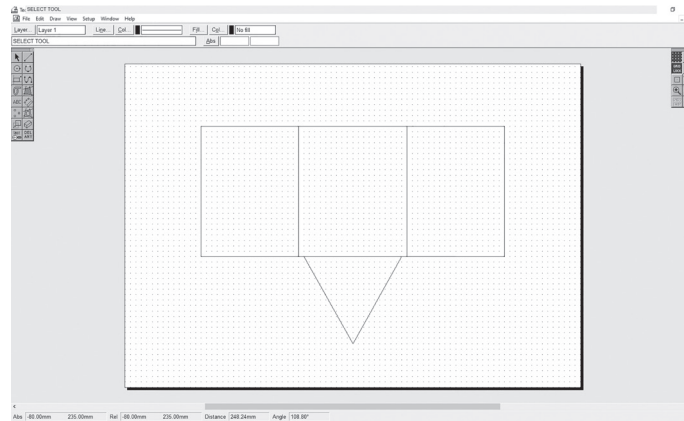


Fig. 11.2

Describe how the development (net) could be cut out using CAM from the CAD drawing.

.....

.....

.....

.....

.....

.....

.....

[4]

(b) Explain why acrylic could be considered a 'smart' material.

.....

.....

..... [2]

(c) Fig. 11.3 shows the development (net) of one container.

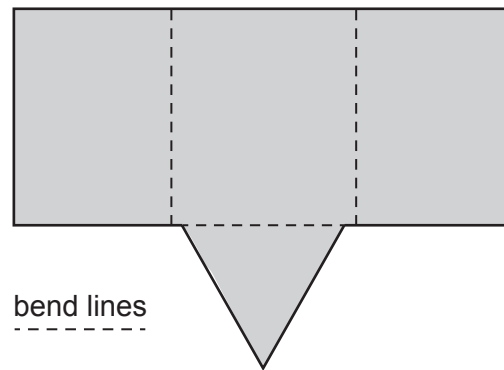


Fig. 11.3

Use sketches and notes to show how the development (net) could be bent to the shape of the container.

[5]

(d) The containers will be joined together using acrylic cement.

(i) State **two** safety precautions that must be taken when using acrylic cement.

1

2 [2]

(ii) Use sketches and notes to show how **two** containers could be clamped together after the acrylic cement has been applied.

[2]

(e) Children need to access the organiser when sitting at a table.

Use sketches and notes to show how the organiser could be made to rotate on an additional base.

Include details of the materials and constructions used.

[5]

- (f) Use sketches and notes to show a design for a handle that could be attached to the organiser that would make it easier to carry.
Include details of the materials and constructions used.

[5]

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Question 12 begins on page 12.

12 Fig. 12.1 shows a wall-mounted cycle rack made from mild steel.

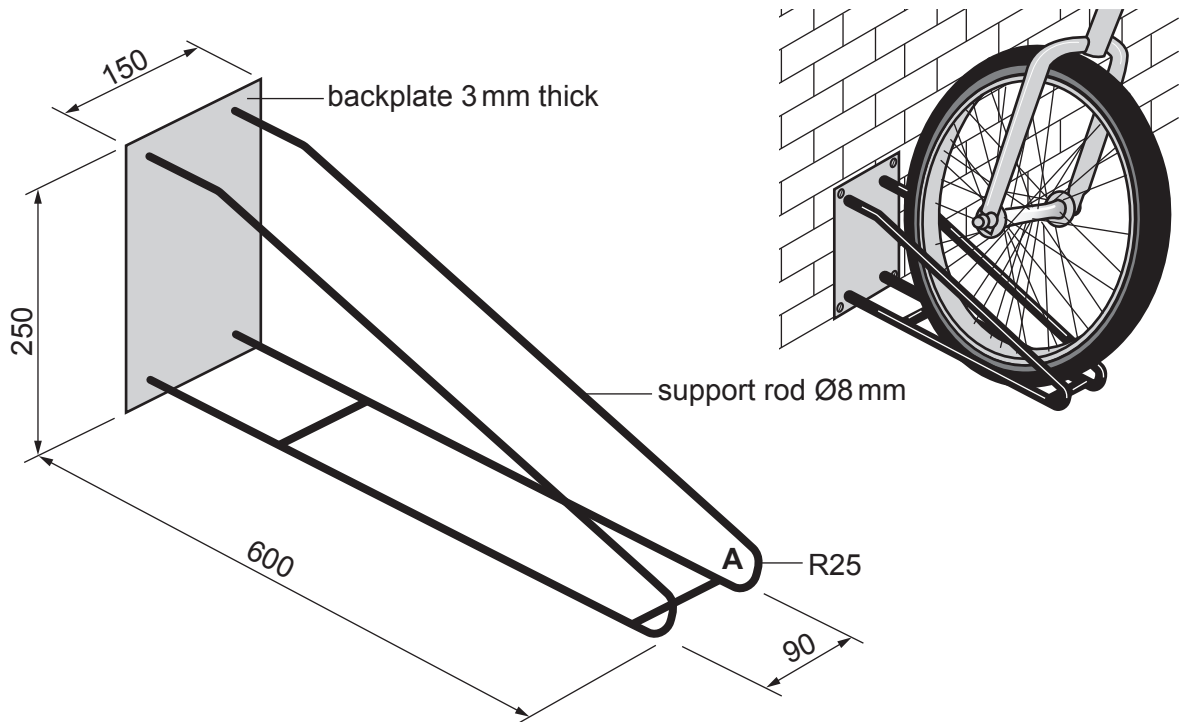


Fig. 12.1

- (a) State **three** items of research that a designer would need to consider when designing the cycle rack.

1

2

3

[3]

- (b) Fig. 12.2 shows the backplate with centres marked where holes will be drilled to take the Ø8 support rods.

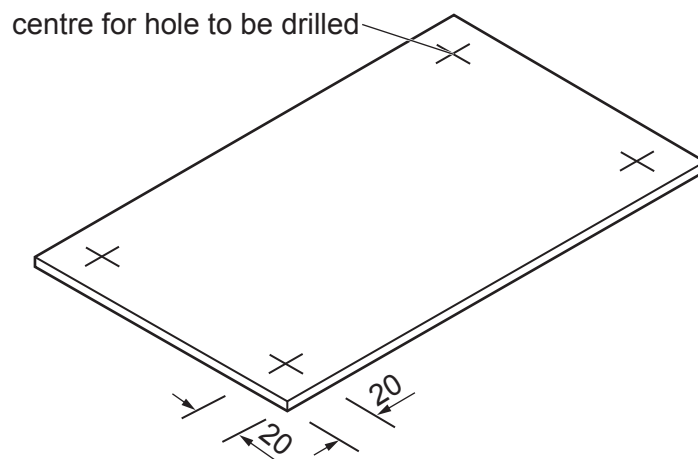
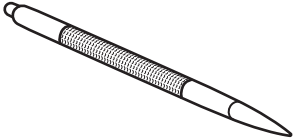
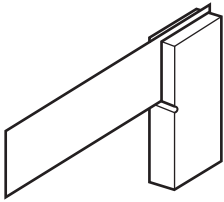
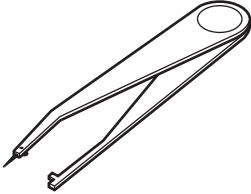


Fig. 12.2

- (i) Table 12.1 shows three marking out tools that could be used to mark out the centres shown in Fig. 12.2.

Complete Table 12.1 by naming the marking out tools shown.

Table 12.1

Marking out tool	Name of marking out tool
	
	
	

[3]

- (ii) A centre punch would be used to make an indentation in the surface of the backplate so that the holes could be drilled accurately.
 Use sketches and notes to show a design for a jig that would locate the positions for the centre punch without the use of the marking out tools.
 Include the name of the material used to make the jig and state **one** important size.

[5]

- (c) Fig. 12.3 shows a bending jig that could be used when bending the support rods to the shape shown at **A** in Fig. 12.1.

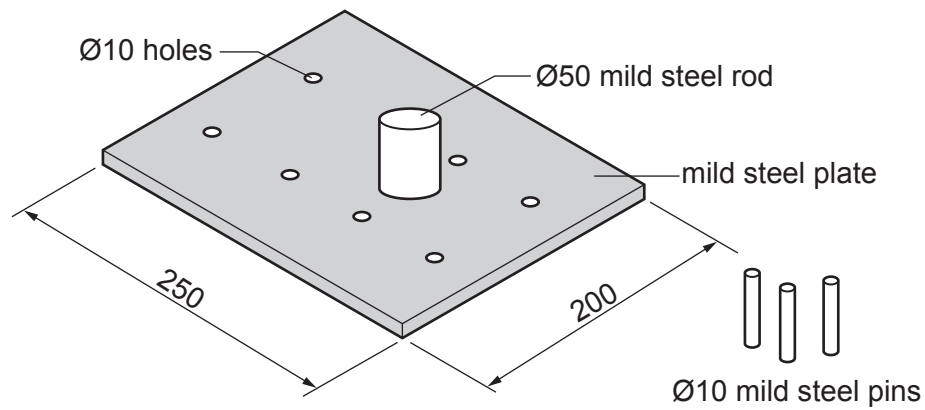


Fig. 12.3

- (i) Show the positions of the support rod and **three** Ø10 mild steel pins on Fig. 12.4, to produce bend **A**.

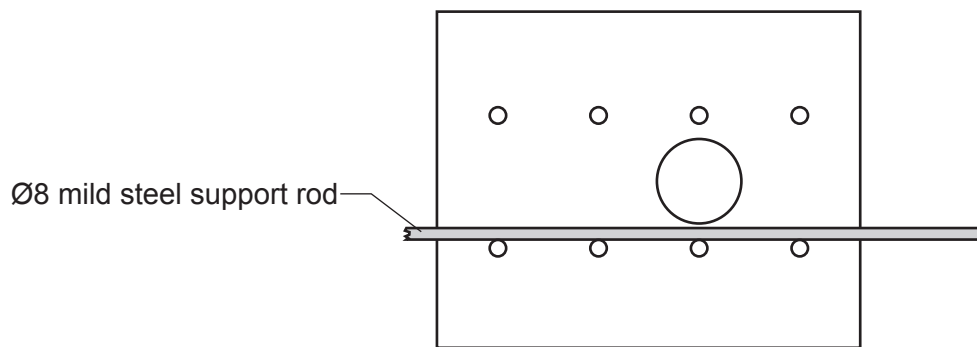


Fig. 12.4

[3]

- (ii) State **one** benefit of heating the mild steel support rod before bending it to shape.

..... [1]

- (d) Fig. 12.5 shows an item of equipment that could be used when brazing the support rods to the backplate.

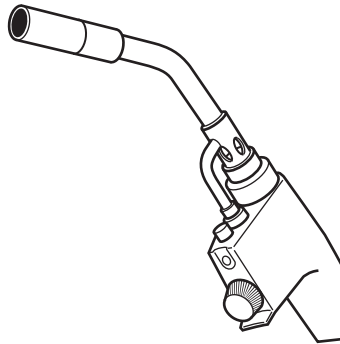


Fig. 12.5

- (i) Name the item of equipment shown in Fig. 12.5.
 [1]
- (ii) Name **two** abrasives that could be used to clean the mild steel support rods before they are brazed.
 1
 2 [2]
- (iii) Flux will be applied to the joints before brazing.
 State the purpose of the flux.
 [1]
- (e) The cycle rack will have an applied painted finish.
 State **two** other suitable types of finish that could be applied to the cycle rack.
 1
 2 [2]

- (f) Fig. 12.6 shows an exploded view of a modification to the design of the cycle rack shown in Fig. 12.1. The support rods and backplate have been replaced with 15 mm thick plywood.

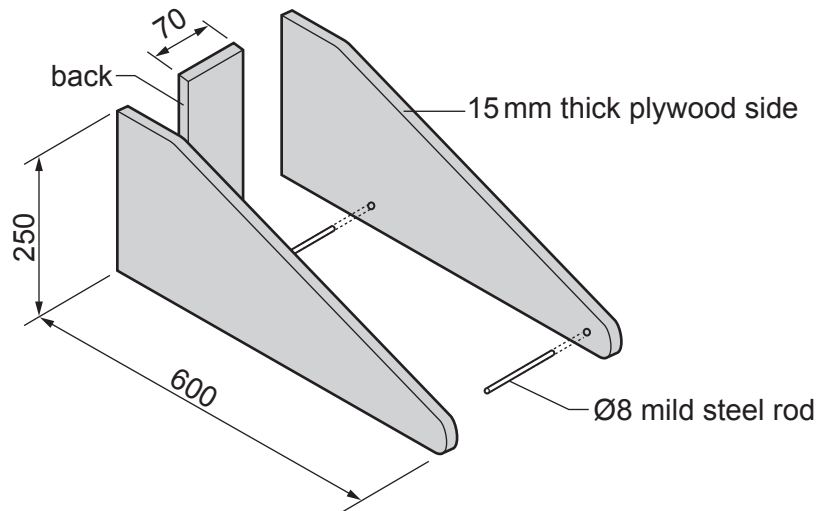


Fig. 12.6

Fig. 12.7 shows one side of the cycle rack and a box that will be fitted to the side. The box will store items of equipment used for cycle maintenance.

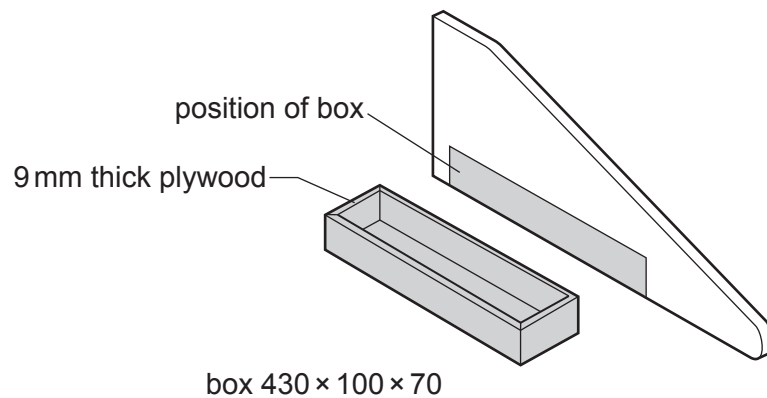


Fig. 12.7

Use sketches and notes to show how the box could be fastened to the side of the cycle rack but could be removed quickly and easily to access the equipment. Include details of the materials and fittings used.

- 13 Fig. 13.1 shows an incomplete design for a wall-mounted shelf unit for a bathroom. The end frames are made from softwood. The shelves are made from manufactured board.

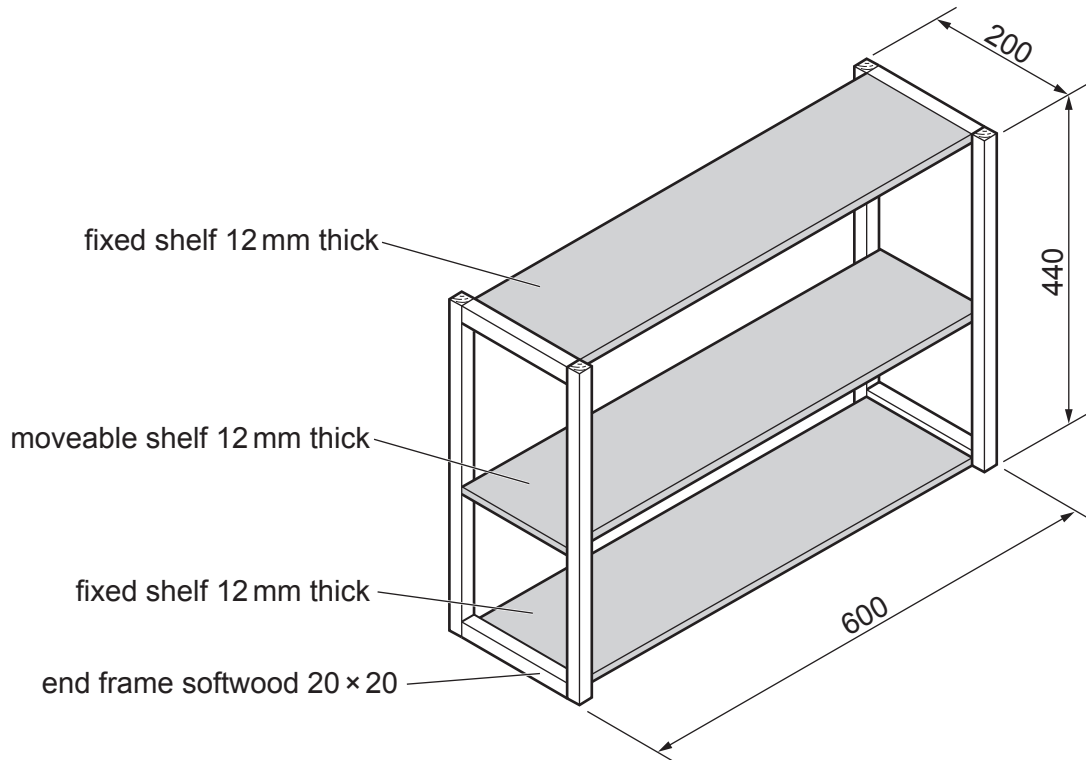


Fig. 13.1

- (a) (i) Name a suitable softwood for the end frames.

..... [1]

- (ii) Name a suitable manufactured board for the shelves.

..... [1]

- (b) State **two** factors a designer would need to consider when designing products for use in a bathroom.

1

2

[2]

- (c) A corner bridle joint will be used to join the parts of the frame.
Fig. 13.2 shows one corner of an end frame.
Complete Fig. 13.2 to show an exploded view of a corner bridle joint.

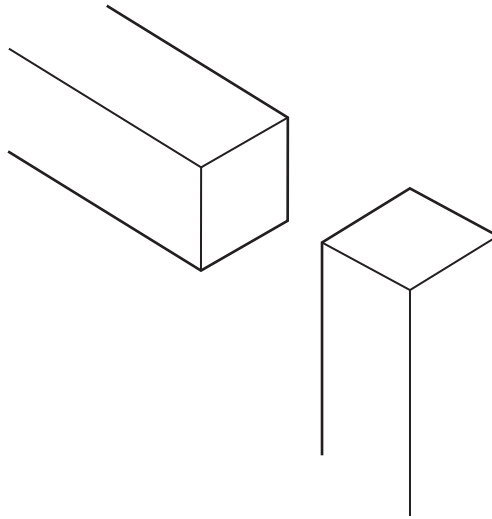


Fig. 13.2

[3]

- (d) Fig. 13.3 shows one end of a fixed shelf and part of an end frame.
Complete Fig. 13.3 to show a joint that could be used to join the fixed shelf to the end frame.

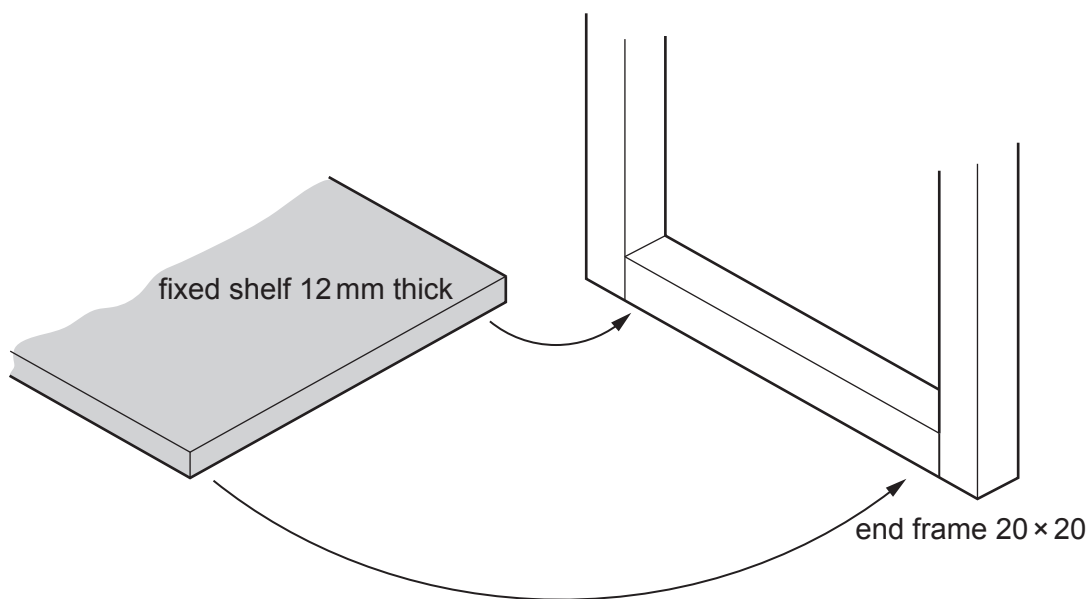


Fig. 13.3

[4]

- (e) Fig. 13.4 shows the end frame and moveable shelf. Use sketches and notes to show how the shelf could be supported at **three** different heights. The shelf must be prevented from sliding horizontally inside the end frame. Include details of the materials, constructions and fittings used.

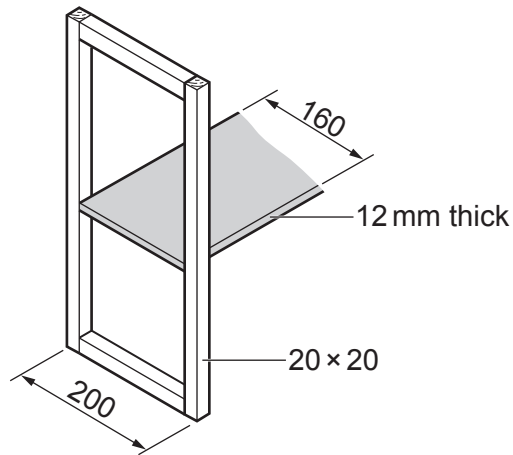


Fig. 13.4

[6]

- (f) Use sketches and notes to show how the shelf unit could be fitted securely against a wall. Include details of the materials, fittings and fixings used.

[4]

- (g) Each end frame could be replaced with a single sheet of manufactured board. Give **one** advantage and **one** disadvantage to the manufacturer of replacing the end frames with a manufactured board when making a large quantity of shelf units.

Advantage to manufacturer

.....

Disadvantage to manufacturer

.....

[2]

- (h) Explain why the materials used to make the shelf unit could be considered sustainable.

.....

.....

..... [2]

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