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DESIGN & TECHNOLOGY

0445/31

Paper 3 Resistant Materials

May/June 2023

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 cordless drill.



Fig. 1.1

Identify **three** ergonomic features of the cordless drill.

- 1
- 2
- 3

[3]

2 Fig. 2.1 shows views of a butt joint using softwood 60 mm wide × 15 mm thick.

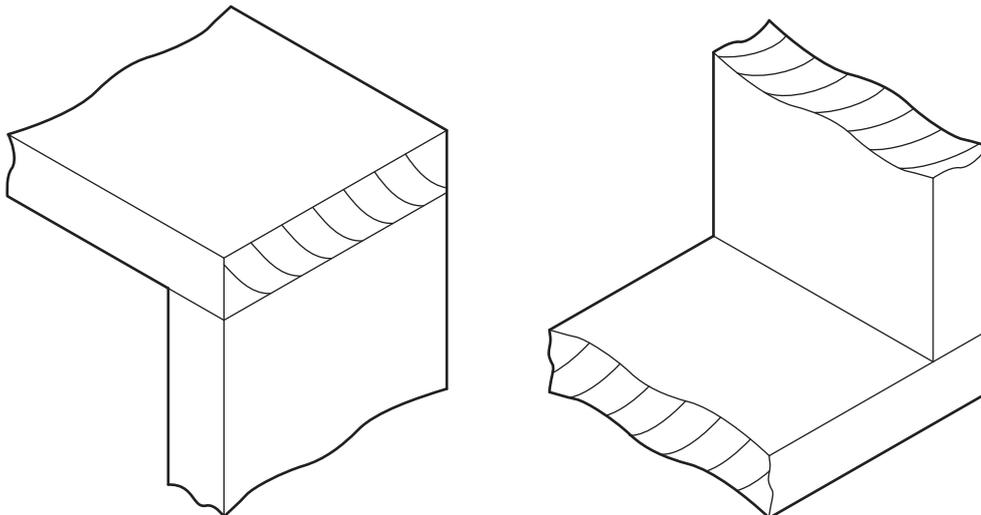


Fig. 2.1

Add sketches and notes to Fig. 2.1 to show how the butt joint could be strengthened.

[3]

3 Fig. 3.1 shows two tools, **A** and **B**, that can be used to cut sheet metal.

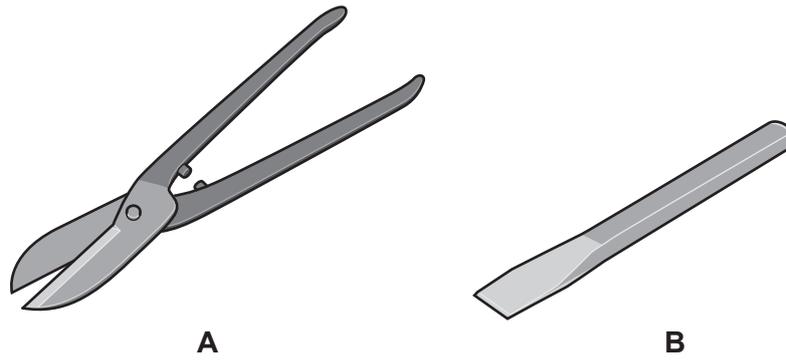


Fig. 3.1

Give the name of the tools labelled **A** and **B** in Fig. 3.1.

A

B

[2]

4 Fig. 4.1 shows a hardwood block with a line measured and marked out 100 mm from the datum face.

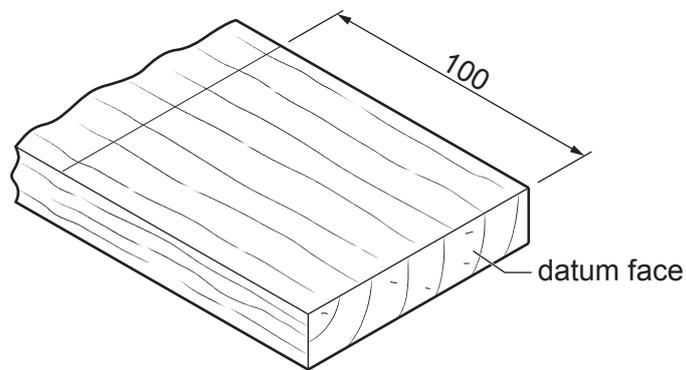


Fig. 4.1

Describe the purpose of the datum face.

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

5 Select the plastic from the list below that corresponds to the description.

expanded polystyrene PVC nylon polyester resin phenol formaldehyde

(a) Good chemical and weather resistance, used for pipes, guttering and window frames.

..... [1]

(b) Hard, brittle, heat resistant, used for dark electrical fittings, saucepan and kettle handles.

..... [1]

6 Fig. 6.1 shows an incomplete design for a bracket made from 3 mm thick mild steel strip that will be fixed to a wall.

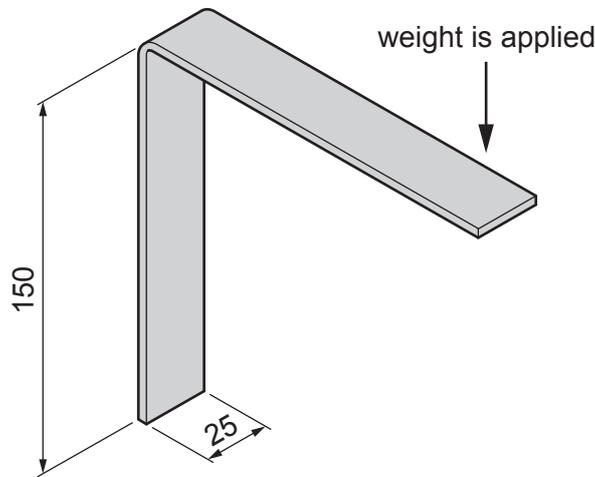


Fig. 6.1

Use sketches and notes to show how the bracket could be strengthened.

7 Fig. 7.1 shows a hardwood rail, 40 × 25, with a recess cut out, ready to take a butt hinge.

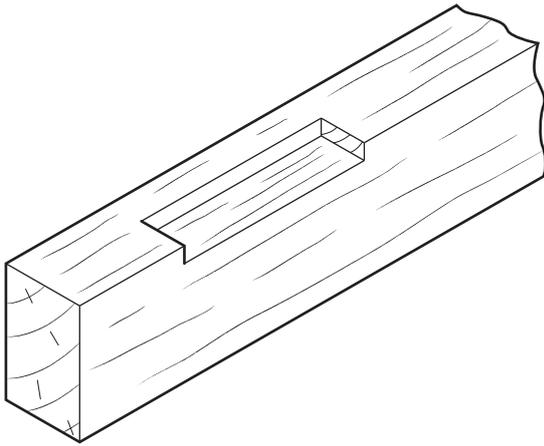


Fig. 7.1

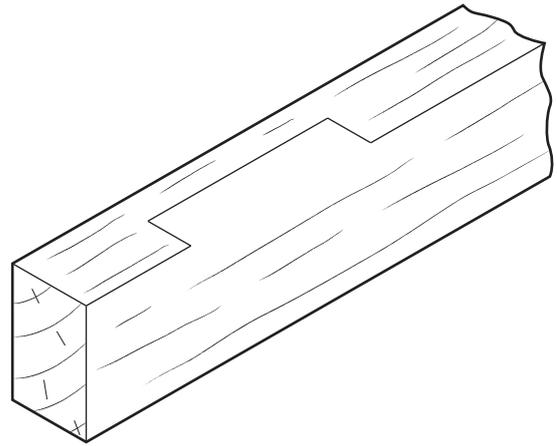
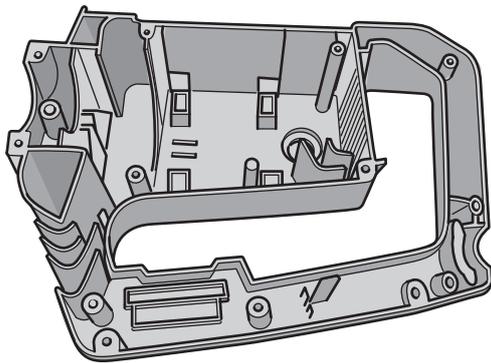


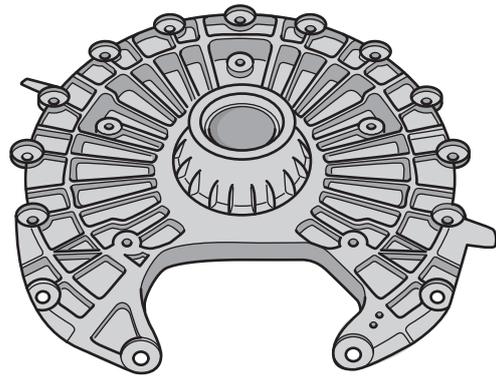
Fig. 7.2

Add sketches to Fig. 7.2 to show a complete butt hinge fitted into the recess. [3]

8 Fig. 8.1 shows two components, **A** and **B**, that have been produced by different manufacturing processes. Component **A** is made of plastic. Component **B** is made of metal.



A



B

Fig. 8.1

Name the manufacturing process that has been used to produce each component.

Component **A**

Component **B**

[2]

- 9 Fig. 9.1 shows items of equipment used in a process to join metals together permanently.

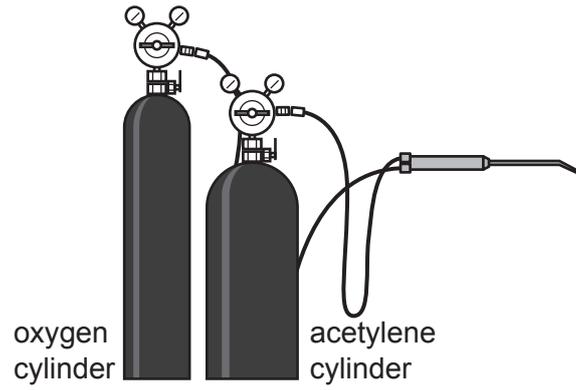


Fig. 9.1

Name a process in which the items of equipment would be used.

..... [1]

10 Fig. 10.1 shows a sheet of 4 mm thick hardboard.

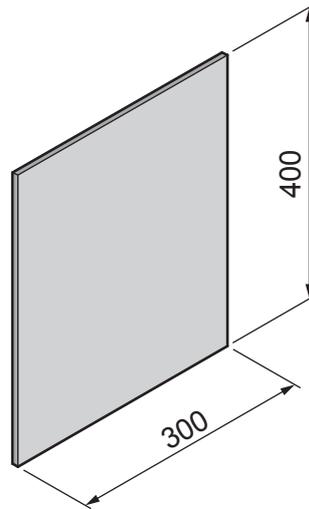


Fig. 10.1

Use sketches and notes to show how a softwood frame could be joined to the hardboard to make a 'flush' door.

[4]

Section B

Answer **one** question from this section.

- 11 Fig. 11.1 shows an incomplete design for a sweet dispenser. The sweet dispenser is made from 5 mm thick MDF with a clear plastic window. The mechanism that allows sweets to fall when the handle is turned has been removed.

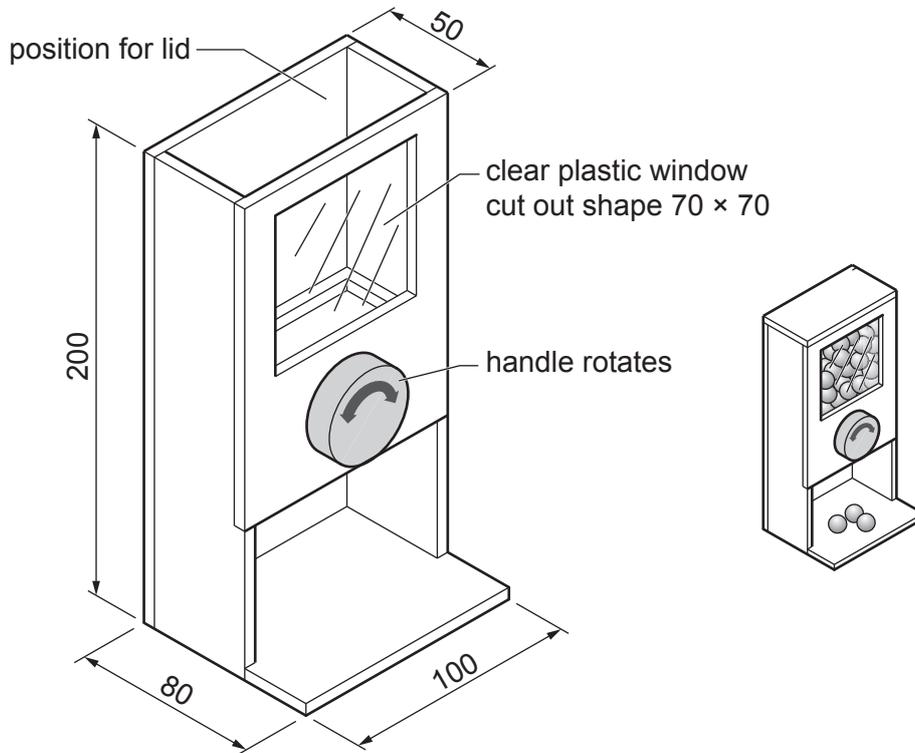


Fig. 11.1

- (a) (i) State **two** properties of MDF that make it suitable for the sweet dispenser.

1

2

[2]

- (ii) Name **one** other manufactured board that could be used to make the sweet dispenser.

..... [1]

- (iii) Name a suitable plastic, other than acrylic, that could be used for the window.

..... [1]

(b) Give **two** reasons why it would be important to make a card model of the sweet dispenser before making it from MDF.

1

2

[2]

(c) Use sketches and notes to show how the window could be cut out and the edges made flat and smooth using hand and/or machine tools.
Name all the tools and equipment used.
State **one** safety precaution that must be taken.

Safety precaution

[5]

- (d) Fig. 11.2 shows details of the handle. Two discs are needed to make the handle to turn the mechanism. One disc has a Ø5 hole drilled through it. The second disc has a 'blind' hole 8 mm deep.

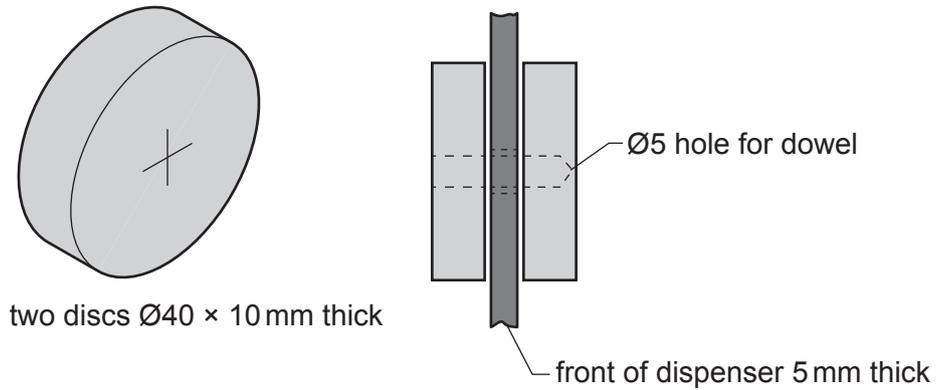


Fig. 11.2

Use sketches and notes to show how the **two** discs, including the holes, could be produced from 10 mm thick MDF sheet.
Name all the tools and equipment used.

[5]

- (e) The parts of the sweet dispenser will be joined using a contact adhesive.

- (i) State **one** benefit and **one** drawback of using a contact adhesive to join the parts of the sweet dispenser.

Benefit

.....

Drawback

.....

[2]

- (ii) Describe how the contact adhesive would be used to join the parts of the sweet dispenser.

.....

.....

[2]

- (f) Use sketches and notes to show a design for a lid that could be fitted in the position shown in Fig. 11.1.
The lid must allow easy access to fill the dispenser.
Show all constructional details and state **two** important sizes.

[5]

12 Fig. 12.1 shows an incomplete design for an adjustable stand to support a tablet. The stand is made of 4 mm thick acrylic and could be made in a school workshop.

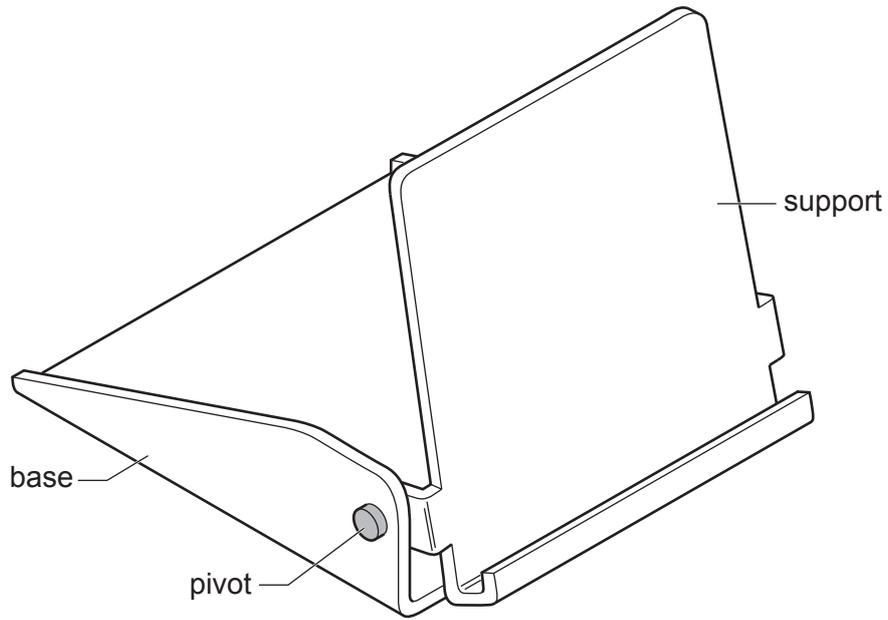


Fig. 12.1

(a) Acrylic is a thermoplastic. State **one** advantage of making the stand from a thermoplastic rather than a thermosetting plastic.

..... [1]

(b) Fig. 12.2 shows the development (net) of the base marked out on a sheet of acrylic.

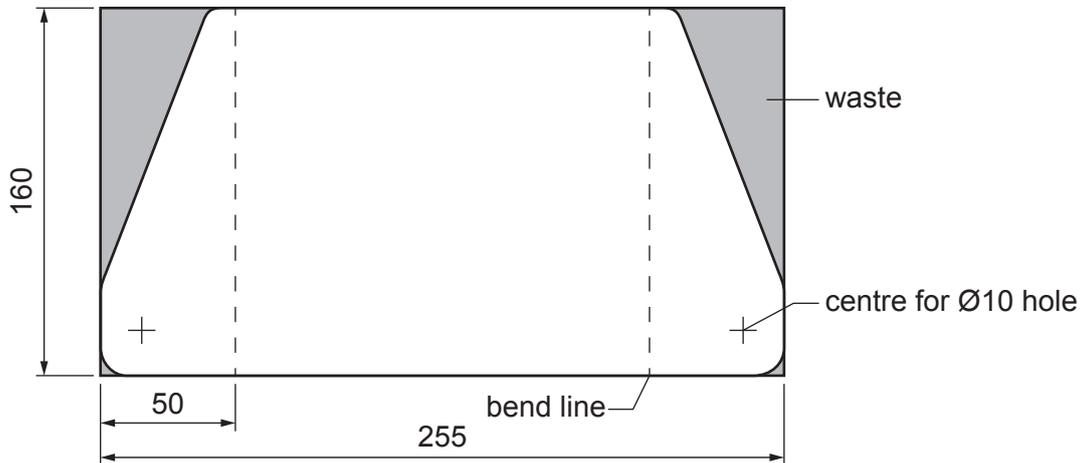


Fig. 12.2

(i) Name **two** tools or items of equipment that could be used to mark out the lines on the surface of the acrylic sheet.

1

2

[2]

(ii) Name **two** types of saw that could be used to remove the waste material.

1

2

[2]

(c) The Ø10 holes will be drilled before the acrylic is bent to the shape of the base. Use sketches and notes to show **two** precautions, other than Personal Protective Equipment (PPE), that need to be taken when using a drilling machine to drill the holes in the acrylic sheet.

[3]

(d) Fig. 12.3 shows an item of equipment that could be used to soften the acrylic so that it could be bent to the shape of the base.

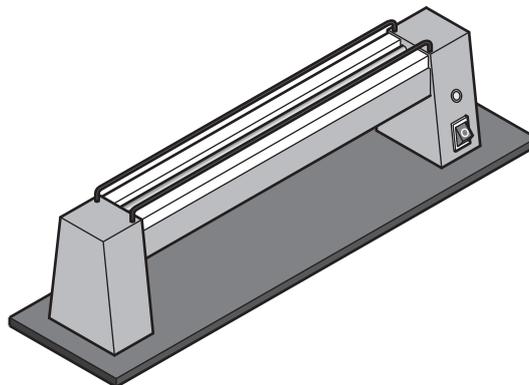


Fig. 12.3

(i) Name the item of equipment shown in Fig. 12.3.

..... [1]

(ii) Use sketches and notes to show how the acrylic could be bent to the shape of the base.

[3]

(e) Fig. 12.4 shows a side view of the stand and the angles to which the support must be adjusted.

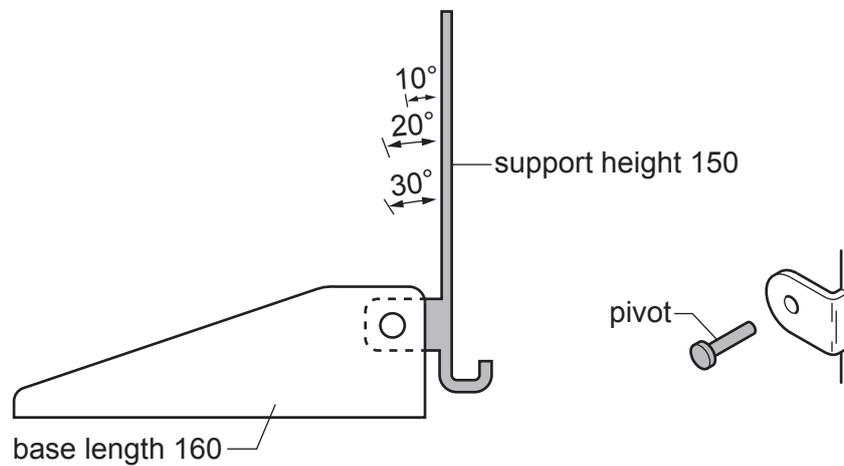


Fig. 12.4

Use sketches and notes to show how the support could be locked at **four** different positions, starting with the upright position, then at 10°, 20° and 30°. Give details of all materials and constructions used.

[5]

(f) The adjustable stand could also be made from 1.0 mm thick stainless steel sheet.

(i) State **two** properties of stainless steel that make it suitable for the adjustable stand.

1

2

[2]

(ii) Use sketches and notes to show how the development (net) shown in Fig. 12.2 could be bent to form the base of the adjustable stand when made from stainless steel. Name all the tools and equipment used.

[4]

(g) The adjustable stand could be designed using CAD. State **two** benefits, other than speed and accuracy, of using CAD to design the adjustable stand.

1

2

[2]

13 Fig. 13.1 shows a desk organiser made from hardwood.

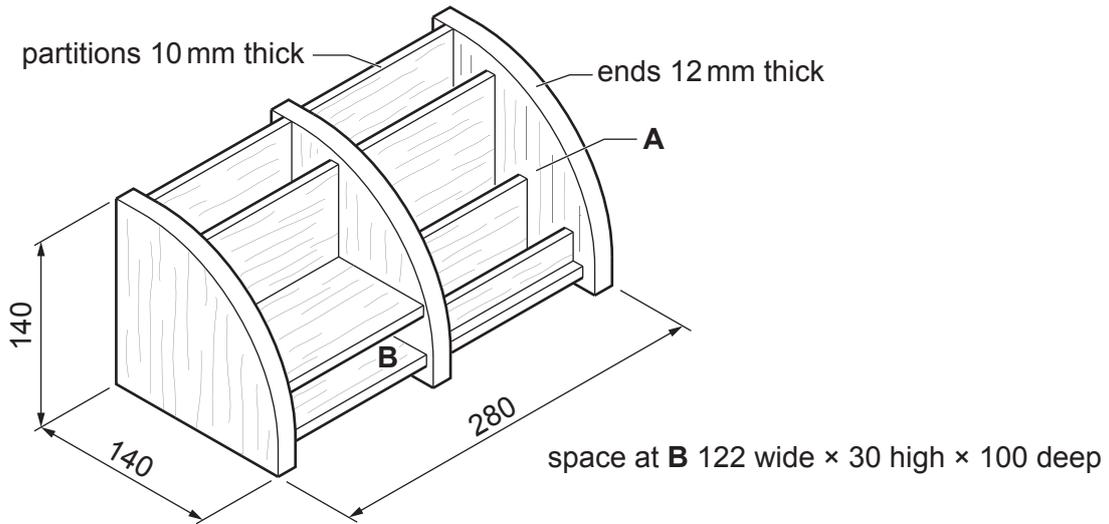


Fig. 13.1

(a) State **two** items of research the designer would have considered when designing the desk organiser.

1

2

[2]

(b) A questionnaire was given to 100 people asking them to list three main features of a well-designed desk organiser.

Fig. 13.2 shows the results of the questionnaire in the form of a pie chart.

From the pie chart shown in Fig. 13.2 state the **three** most important features.

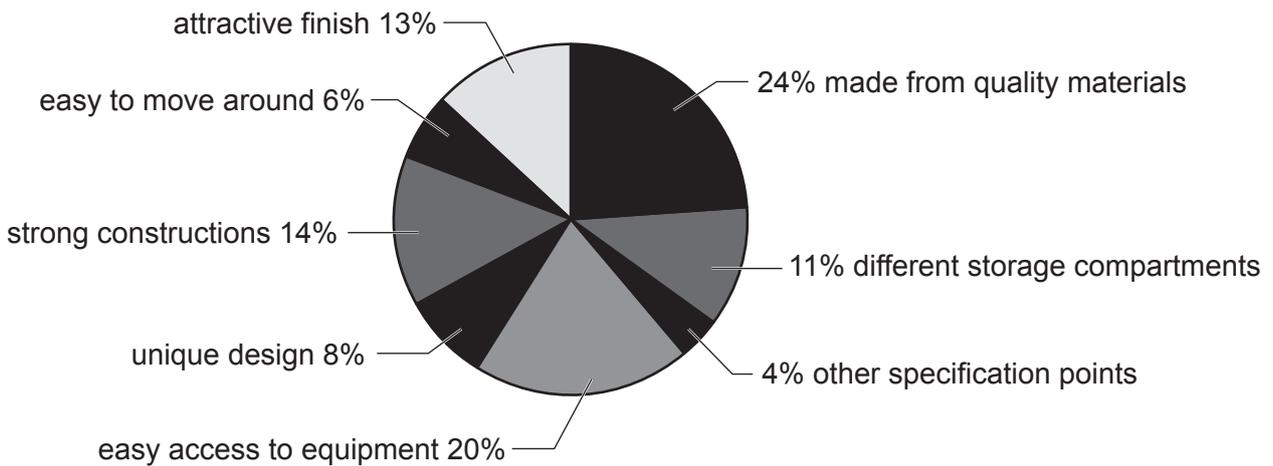


Fig. 13.2

1

2

3

[3]

- (c) Fig. 13.3 shows the ends and the centre piece of the desk organiser marked out on a length of hardwood ready to be cut and shaped.

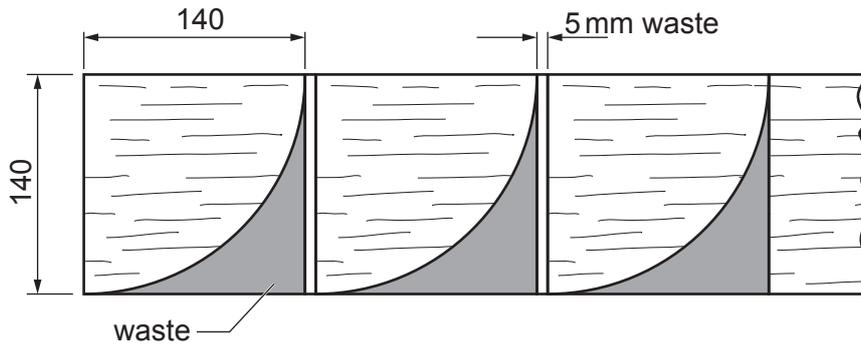


Fig. 13.3

- (i) State **one** benefit of using a template to mark out the shapes of the ends and centre piece.

..... [1]

- (ii) State **one** reason why 5 mm waste has been marked out between each shape.

..... [1]

- (iii) Name a machine saw that could be used to cut each piece to the required shape.

..... [1]

- (d) Fig. 13.4 shows one of the end pieces after it has been sawn to the required shape.

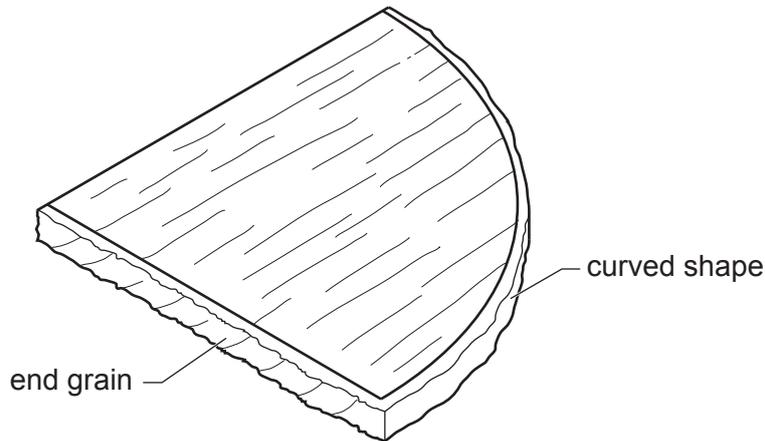


Fig. 13.4

- (i) Describe how the sawn edge of the curved shape could be made smooth.

.....
 [2]

- (ii) When planing end grain there is a danger that the wood could split.
Use sketches and notes to show how to prevent the wood from splitting when it is planed.

[3]

- (e) Fig. 13.5 shows the partition and one end piece that will be joined at **A** shown in Fig. 13.1.

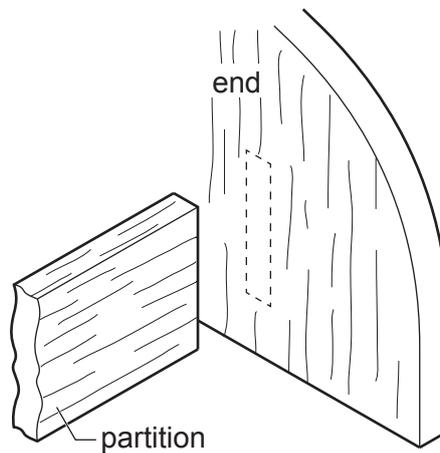


Fig. 13.5

Use sketches and notes to show a suitable method of joining the partition to the end piece.

[3]

- (f) Use sketches and notes to show a design for a drawer that could fit in the space **B** shown in Fig. 13.1.
The drawer must be made of wood-based materials and include some sort of handhold or drawer pull that could be used to open the drawer.
Give details of materials and constructions used.

[4]

- (g) A clear finish will be applied to the desk organiser.
 - (i) State the name of a suitable clear finish, other than varnish, that could be applied to the desk organiser.
..... [1]
 - (ii) When glasspapering the hardwood before the clear finish is applied, the glasspaper could be wrapped around a cork sanding block.
State **one** benefit of using a cork sanding block with the glasspaper.
..... [1]
 - (iii) State **one** reason why it is important to glasspaper along the grain and **not** across it.
..... [1]
- (h) When the desk organiser has been produced, the success of the design will be evaluated. Describe **one** method, other than the use of a questionnaire, by which an evaluation could be carried out.
.....
..... [2]

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