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DESIGN & TECHNOLOGY

0445/32

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 parts **A** and **B** of an incomplete drawing of a twin mortise and tenon joint.

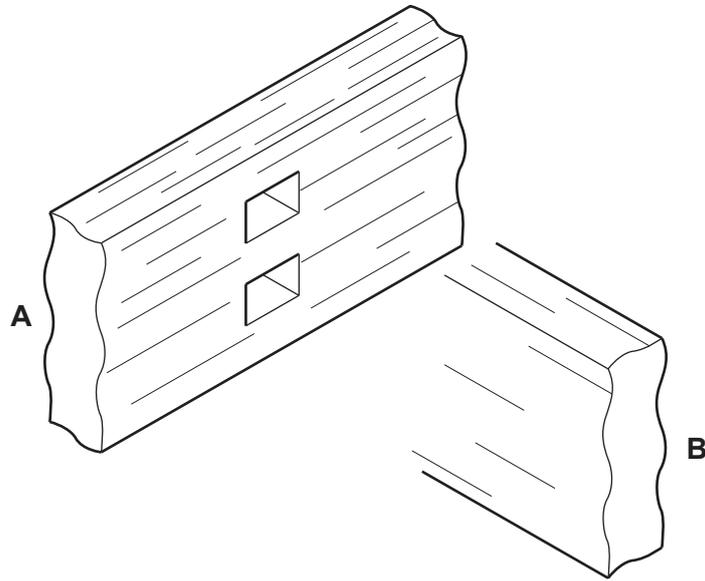


Fig. 1.1

Draw on part **B** in Fig. 1.1 to show the twin tenons.

[3]

- 2 Fig. 2.1 shows a label from the front of a box of steel bolts.

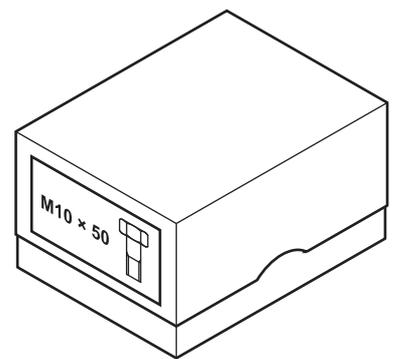
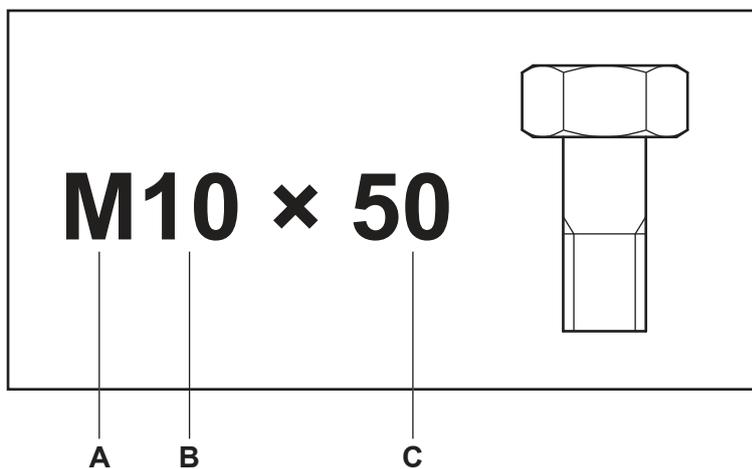


Fig. 2.1

State what is meant by each item of information labelled **A**, **B** and **C**.

A

B

C

[3]

3 Many products are manufactured with built-in obsolescence. Explain, by giving an example of a specific product, what is meant by the term 'built-in obsolescence'.

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

4 Fig. 4.1 shows two different types of caliper, A and B, measuring the diameters of round bars.

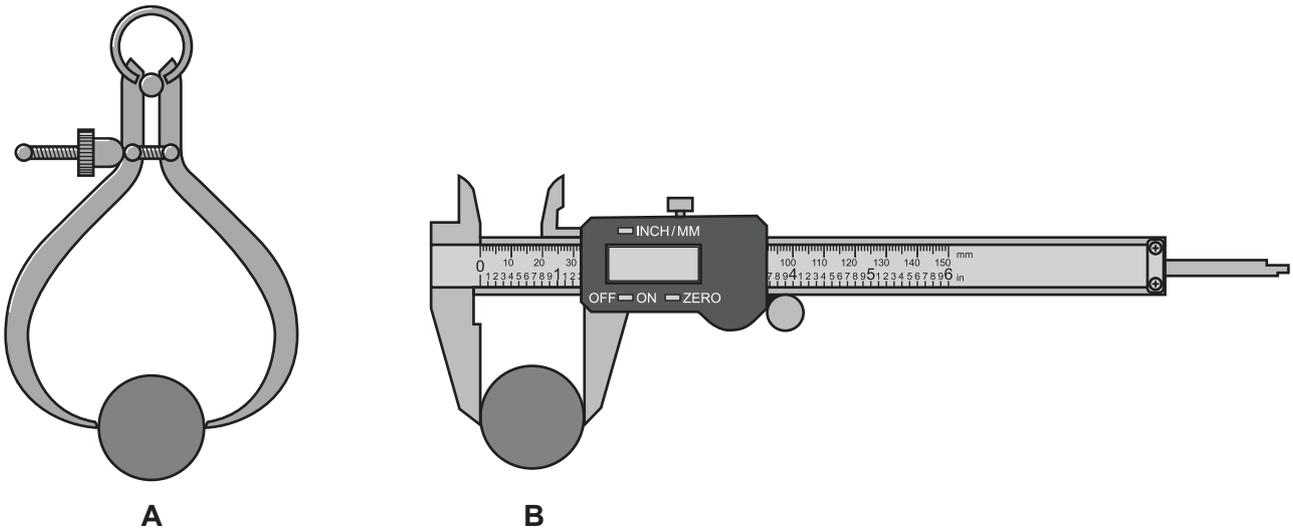


Fig. 4.1

(a) Name the type of caliper labelled B.

..... [1]

(b) Explain why the measurement taken by caliper A will be less accurate than the measurement taken by caliper B.

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

5 CFRP and GRP are examples of composite materials. Complete the names of the composite materials.

(a) C..... Fibre Reinforced Plastic [1]

(b) G..... Reinforced Plastic [1]

6 Fig. 6.1 shows what happens to shape memory alloy (SMA) when it is heated.

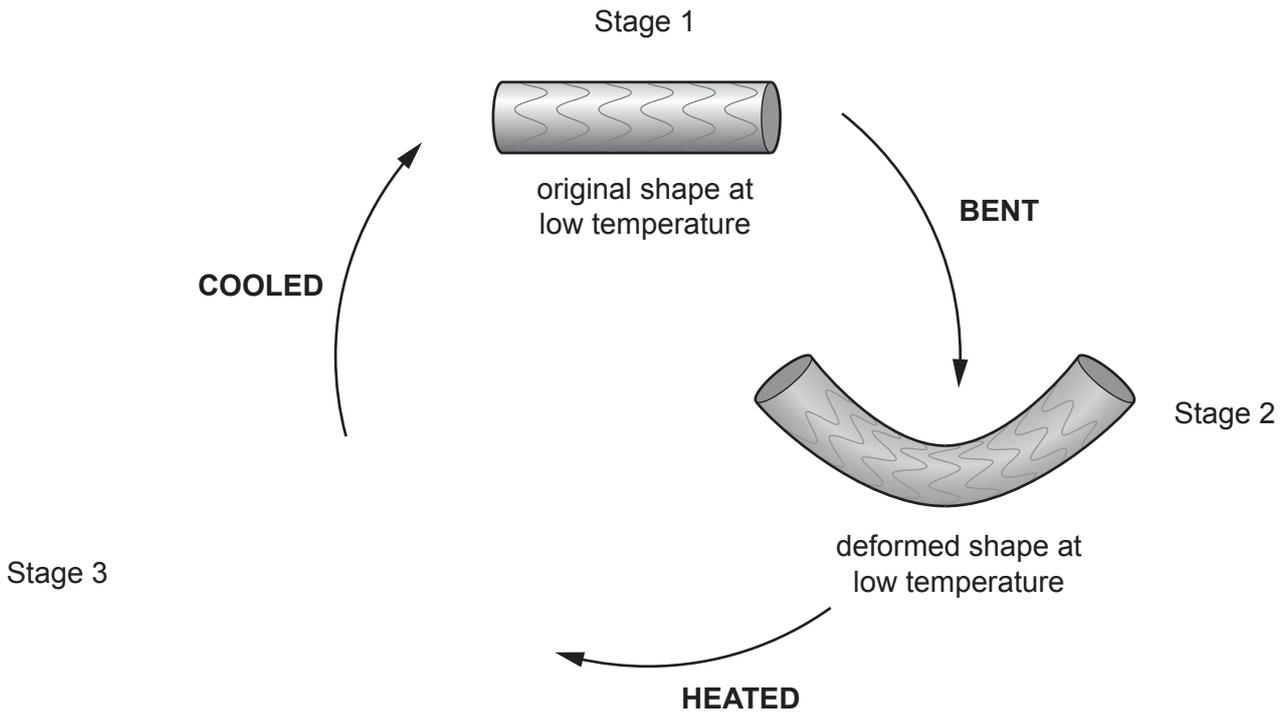


Fig. 6.1

Complete Fig. 6.1 by drawing the shape of the SMA at Stage 3.

[1]

7 Fig. 7.1 shows a copper dish being beaten into shape. When the copper is beaten it becomes 'work hardened'.

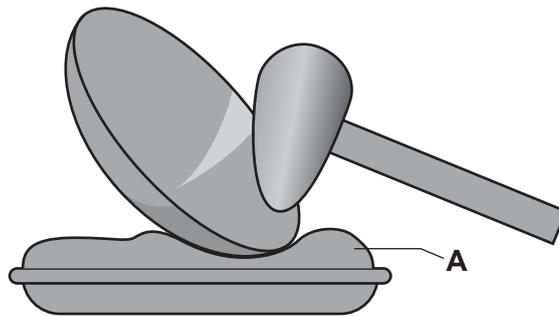


Fig. 7.1

(a) Complete the sentence by adding the correct term from the list.

- soaked alloyed annealed tempered**

To make the copper softer and easier to work, it must be [1]

(b) Name the item of equipment labelled **A**.

..... [1]

8 Fig. 8.1 shows a hardwood box with a hinged lid.

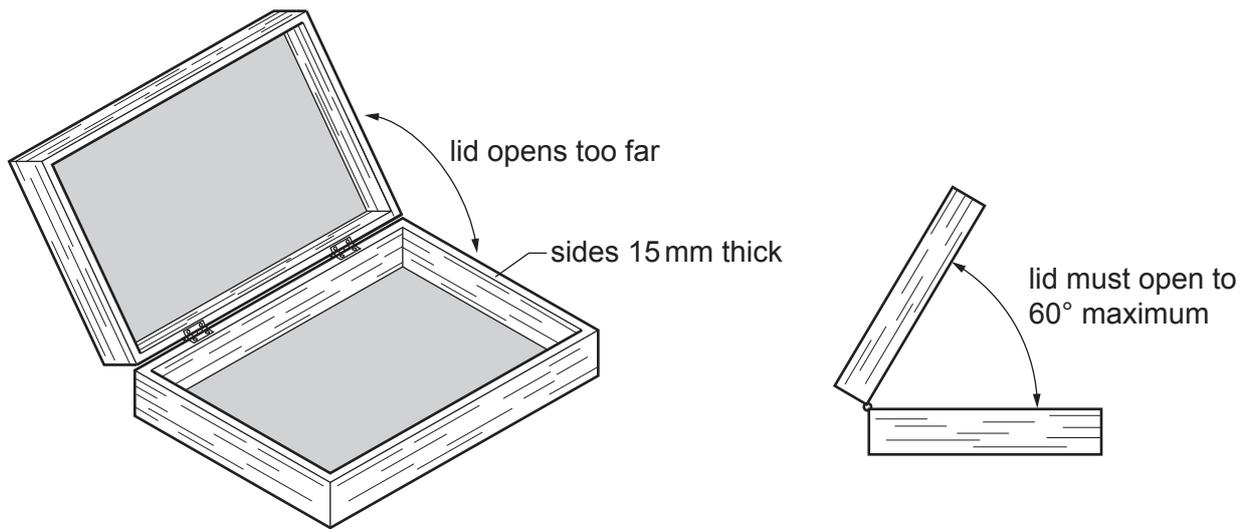


Fig. 8.1

Use sketches and notes to show a fitting that could be attached to the lid and box to prevent the lid from opening more than 60° as shown in Fig. 8.1.

[3]

9 Fig. 9.1 shows a plastic vending cup and the symbol for the plastic from which the cup is made.



Fig. 9.1

(a) Name the type of plastic from which the vending cup is made.

..... [1]

(b) Many fast-food outlets are encouraging customers to reuse their drinks cups.
Give **two** benefits of reusing drinks cups.

1

2

[2]

- 10 Fig. 10.1 shows part of an incomplete design for a towel rack. The backboard is made of hardwood and the arm is made from $\text{Ø}8$ aluminium rod.

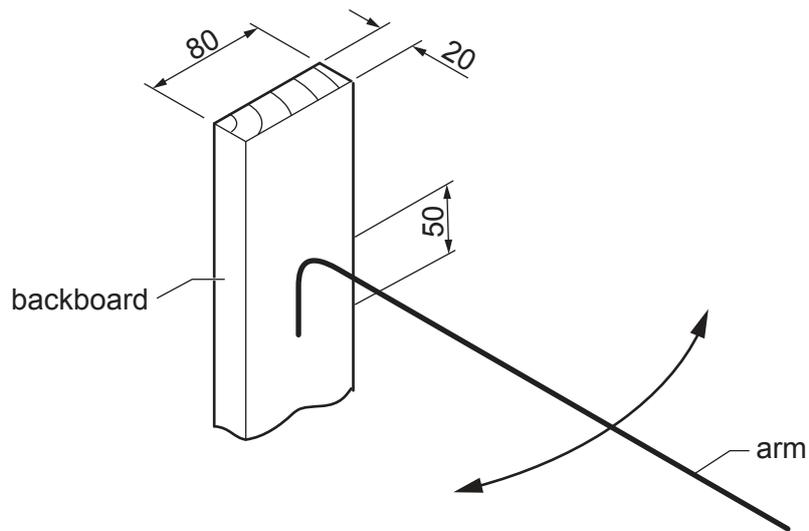


Fig. 10.1

Use sketches and notes to show how the arm could be attached to the backboard and allowed to 'swing' as shown in Fig. 10.1.
Name the materials used.

[3]

Section B

Answer **one** question from this section.

11 Fig. 11.1 shows a portable toolbox made of softwood.

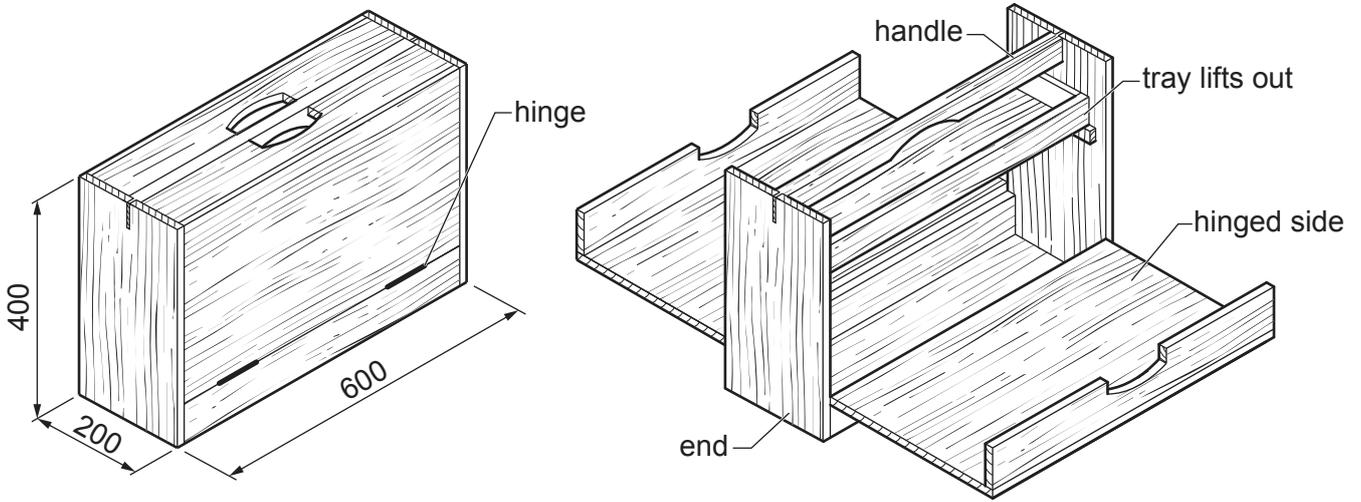


Fig. 11.1

(a) Name a suitable softwood for the toolbox.

..... [1]

(b) Fig. 11.2 shows part of one of the hinged sides which is made by gluing together two softwood boards.

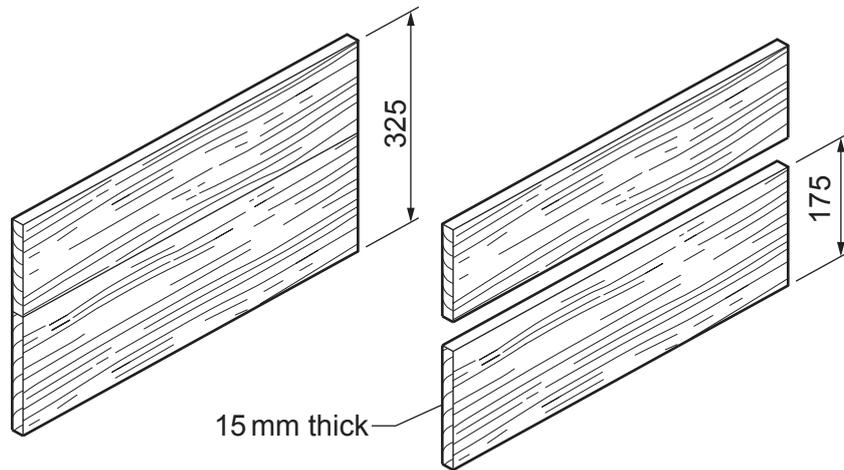


Fig. 11.2

(i) Give **one** reason why two boards are glued together rather than making the side from one board only.

.....
 [1]

- (ii) Use sketches and notes to show how the two boards could be glued and clamped together. Name the type of cramps used.

[3]

- (iii) State **two** checks that should be carried out after the boards have been glued and clamped together.

1

2

[2]

- (c) Fig. 11.3 shows two types of hinge that could be screwed to the toolbox to allow the sides to open and close.

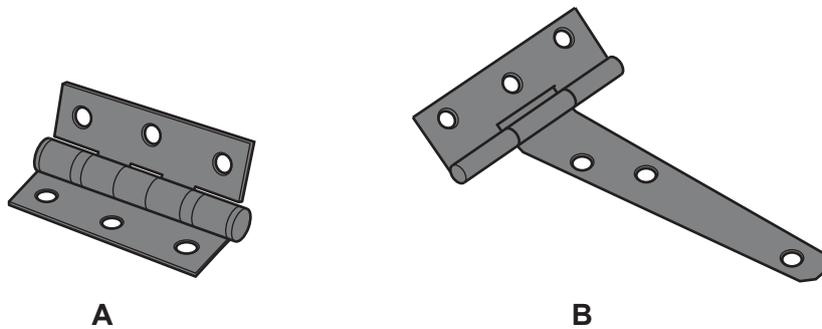


Fig. 11.3

- (i) Name each type of hinge, **A** and **B**.

Hinge **A**

Hinge **B**

[2]

- (ii) Explain why hinge **B** would be more suitable than hinge **A**.

.....
.....
.....

[2]

- (d) Fig. 11.4 shows details of a set of screwdrivers that will be stored on the inside of one of the hinged sides of the toolbox.

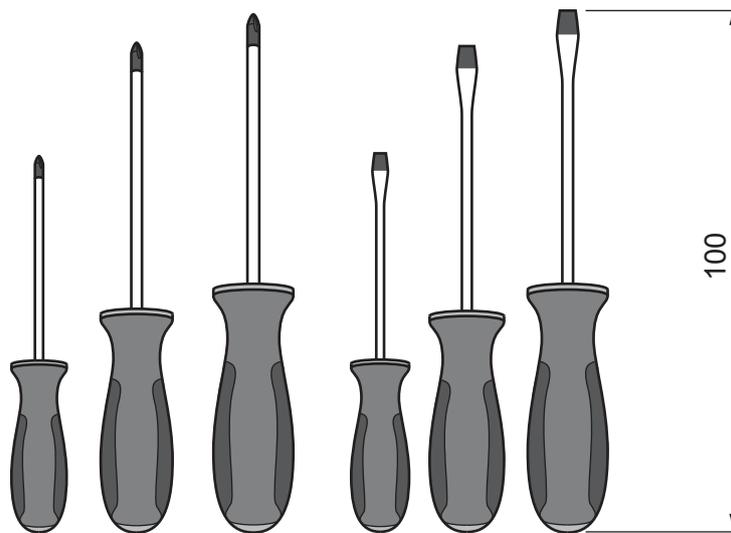


Fig. 11.4

Use sketches and notes to show how the set of screwdrivers could be stored on the inside of a hinged side.

The method of storage must:

- hold **six** screwdrivers safely and securely when the toolbox is carried
- allow for ease of access.

Give details of all materials and constructions used.

- (e) Use sketches and notes to show how the hinged sides shown in Fig. 11.1 could be held securely and prevented from opening when the toolbox is carried.

[3]

- (f) The handle enables the toolbox to be carried.
Fig. 11.5 shows a method of joining the handle to the ends of the toolbox.

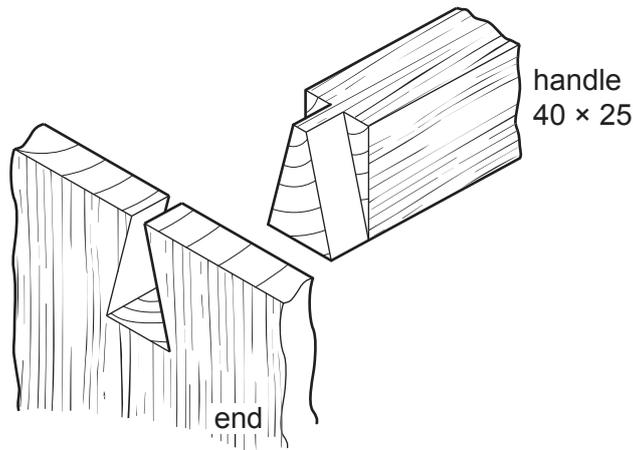


Fig. 11.5

- (i) Name the joint shown in Fig. 11.5.

..... [1]

- (ii) Explain why the method shown in Fig. 11.5 has considerable strength when joining the handle to the ends of the toolbox.

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

(g) Fig. 11.6 shows a commercially manufactured toolbox made from plastic.

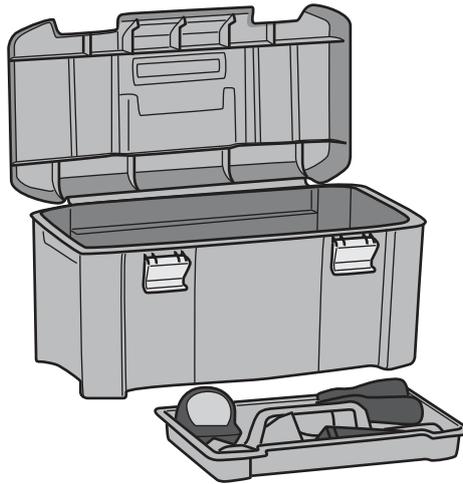


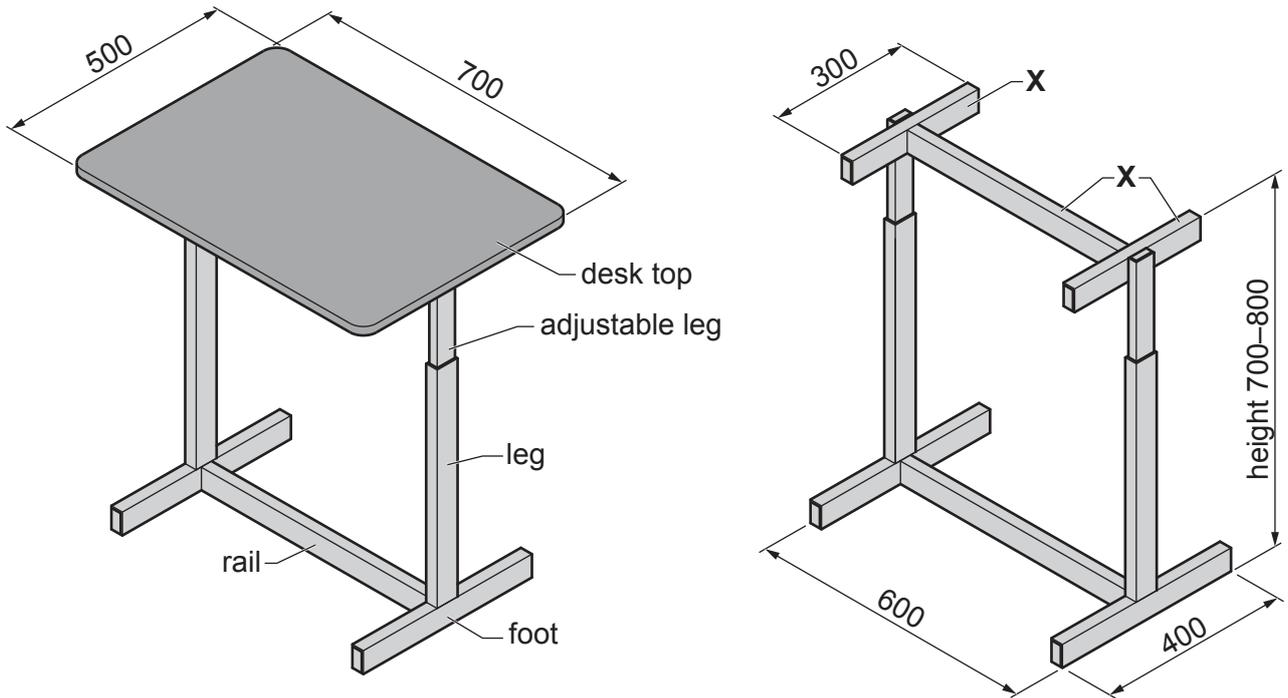
Fig. 11.6

Give **three** advantages of using a toolbox made from plastic rather than the toolbox made from softwood shown in Fig. 11.1.

- 1
- 2
- 3

[3]

12 Fig. 12.1 shows an incomplete design for a desk that could be made in a school workshop. The materials list gives details of the materials from which the desk is made.



Materials List

leg, foot, rail	mild steel tube 50 × 25
adjustable leg	mild steel tube 45 × 20
desk top	veneered plywood 20mm thick

Fig. 12.1

(a) The rectangular mild steel tube used for parts of the desk is a standard metal form. Fig. 12.2 shows two other standard metal forms, **A** and **B**.

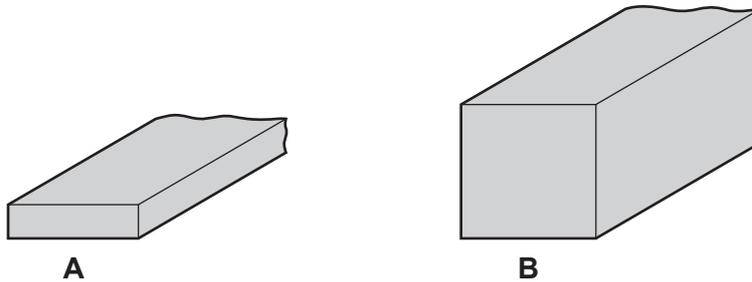


Fig. 12.2

Complete the names of the standard metal forms **A** and **B**.

A strip

B bar

[2]

(b) State **two** different methods that could be used to join the rail and legs to the feet permanently.

1

2

[2]

(c) Use sketches and notes to show how the desk top could be joined to the rails labelled **X** in Fig. 12.1.

The method of joining must be carried out using only basic tools such as screwdrivers and/or Allen/hex keys.

[4]

- (d) The height of the desk can be adjusted between 700–800 mm. Fig. 12.3 shows part of one of the adjustable legs.

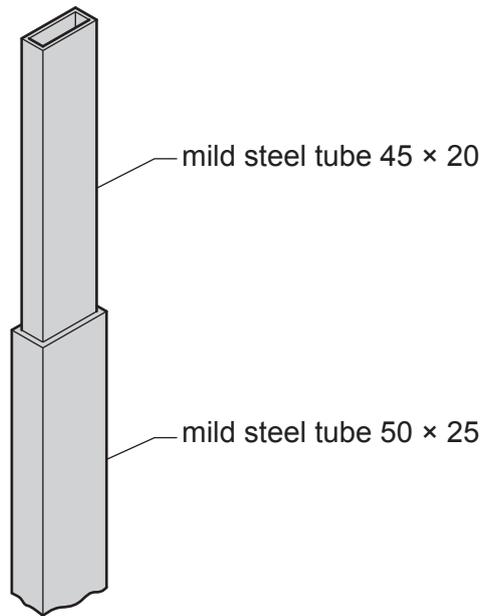


Fig. 12.3

Use sketches and notes to show how the adjustable leg could be locked securely at **any** height between 700–800 mm.
Give details of any fixings and fittings used.

[4]

- (e) Fig. 12.4 shows details of one of the plugs that will be inserted into the ends of the 50 × 25 mild steel tube. The plugs are made of hardwood.

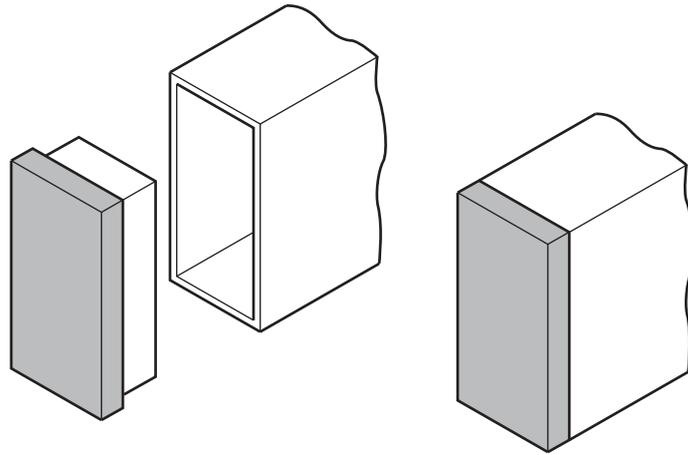


Fig. 12.4

- (i) Give **two** reasons for the plugs.

1

2 [2]

- (ii) The hardwood plugs will be glued into the ends of the mild steel tube.
Name a suitable adhesive that could be used to glue the hardwood plugs into the mild steel tube.

..... [1]

- (f) A small drawer will be added to the desk and supported below the desk top. Fig. 12.5 shows details of the drawer and its position.

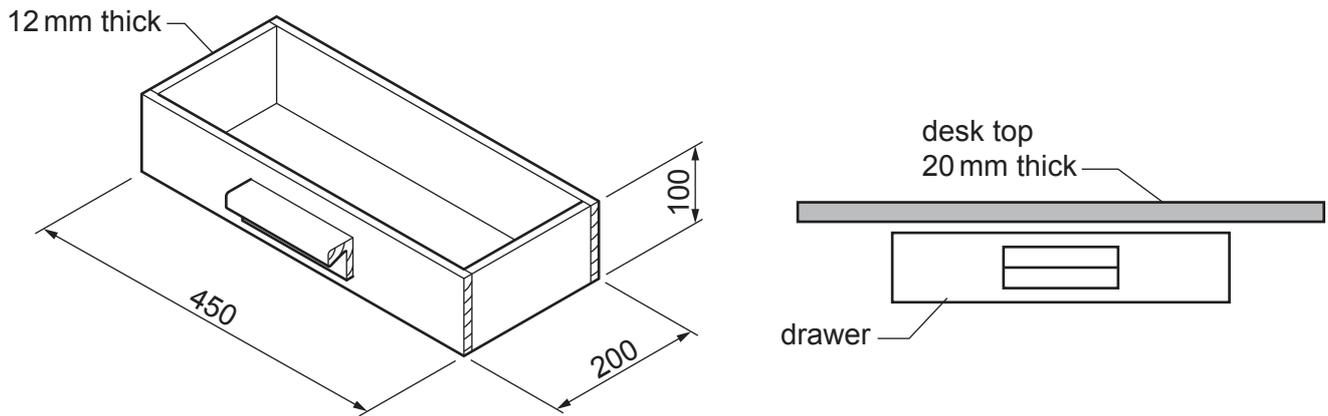


Fig. 12.5

Use sketches and notes to show how the drawer could be supported below the desk top and allowed to be opened and closed. Give details of additional materials used and the constructions carried out to support the drawer in use.

[6]

- (g) Fig. 12.6 shows a palm sander that could be used to make the veneered surface of the desk top smooth before applying a clear varnish finish.

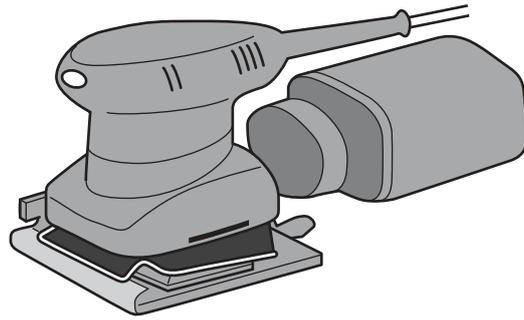


Fig. 12.6

- (i) State **two** reasons why care must be taken when using a palm sander on the veneered surface of the plywood.

1

2

[2]

- (ii) Describe how a clear varnish could be applied to the desk top to achieve a high quality finish.

.....

.....

..... [2]

- 13 Fig. 13.1 shows views of a desk tidy that will be batch produced in a school workshop. The desk tidy is made from acrylic.

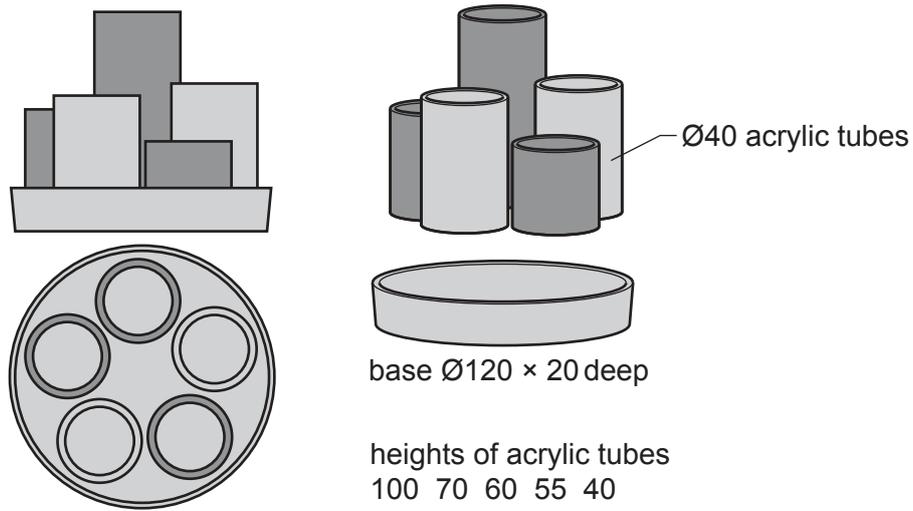


Fig. 13.1

- (a) State **two** properties of acrylic that make it suitable for the desk tidy.

1

2

[2]

- (b) Fig. 13.2 shows a sectional view of a machine used to manufacture the acrylic tube.

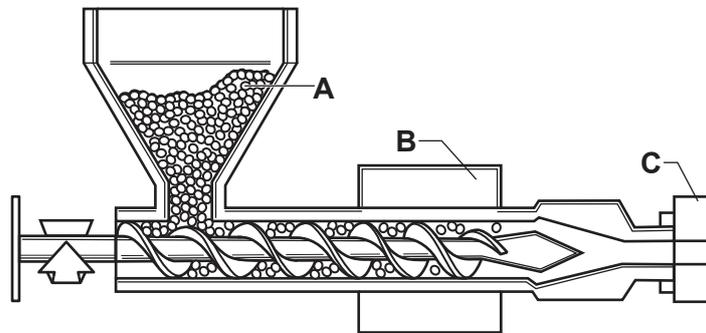


Fig. 13.2

- (i) Name the process used to manufacture the acrylic tube.

..... [1]

(ii) Complete the words for each of the labels, **A**, **B** and **C**, shown in Fig. 13.2.

A plastic g

B h

C d

[3]

(c) Fig. 13.3 shows part of a length of acrylic tube from which five different lengths, 100, 70, 60, 55 and 40 will be sawn.

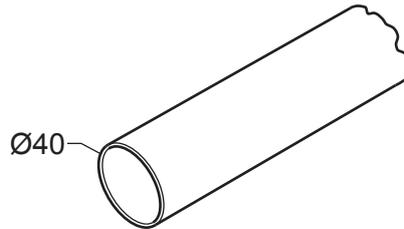


Fig. 13.3

Use sketches and notes to show a design for a sawing jig to be used during batch production that could:

- be held in a vice
- hold the acrylic tube securely while it is sawn
- allow the **five** different lengths to be sawn without the need for measuring and marking out.

Name the materials used to make the sawing jig.

[6]

- (d) The base of the acrylic desk tidy could be produced by the vacuum forming process. Fig. 13.4 shows the mould used to make the base.

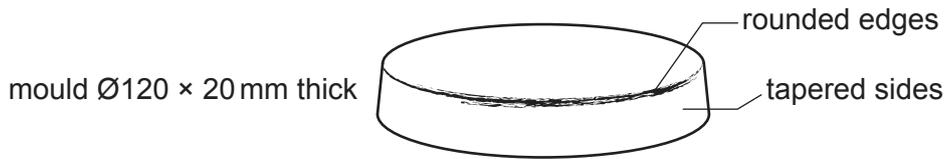


Fig. 13.4

Explain why the mould has rounded edges and tapered sides.

.....

.....

..... [2]

- (e) The base of the desk tidy could also be made by press forming a sheet of 1.5 mm thick acrylic. Fig. 13.5 shows the yoke and plug used in the press forming process.

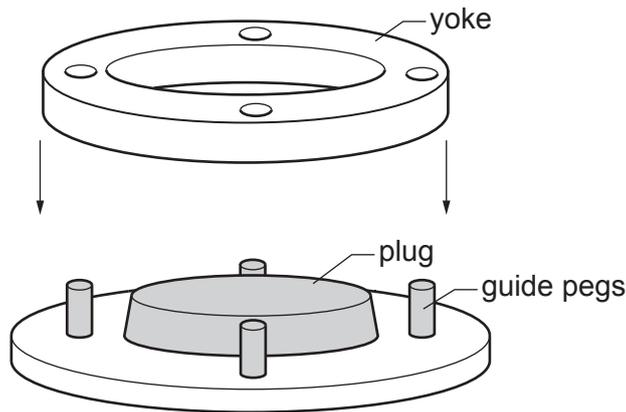


Fig. 13.5

- (i) Describe how the base of the acrylic desk tidy could be produced by the press forming process.

.....

.....

.....

.....

..... [3]

(ii) Give **two** advantages of batch producing the base of the acrylic desk tidy by vacuum forming rather than by press forming.

1

2

[2]

(f) Each of the acrylic tubes has its own position inside the base of the desk tidy. Each tube fits over a hardwood disc that is glued to the base. Fig. 13.6 shows details of one tube and one of the five discs.

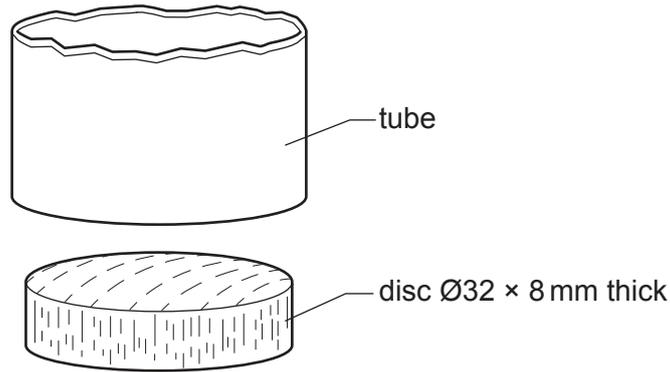


Fig. 13.6

Use sketches and notes to show how **five** identical discs could be made in a school workshop. Give details of the machines, tools and equipment used.

[6]

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