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DESIGN & TECHNOLOGY **0445/32**

Paper 3 Resistant Materials **October/November 2025**

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.

[Turn over

Section A

Answer **all** questions in this section.

1 Fig. 1.1 shows a solid wood board **A**, and the same board **B**, after it has warped.

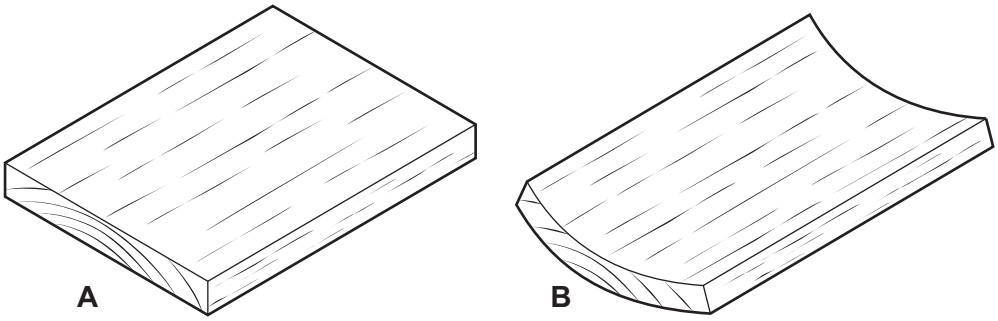

Fig. 1.1

Give **two** reasons why the solid wood board could have become warped.

1 .....

2 .....

[2]

2 Fig. 2.1 shows a saucepan.
The body is made from ferrous metal. The handle is made from thermosetting plastic.

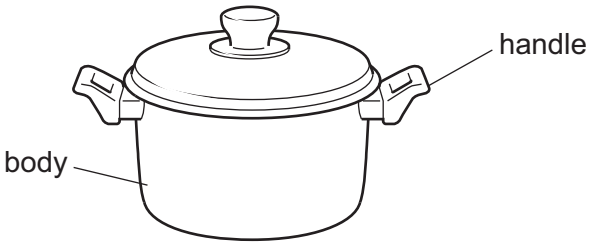

Fig. 2.1

(a) Name a suitable ferrous metal for the body.

..... [1]

(b) Name a suitable thermosetting plastic for the handle.

..... [1]

3 Name the process that uses all the following materials.

gel coat **release agent** **polyester resin**

..... [1]

4 Fig. 4.1 shows two wooden boards that will be joined together by means of a half-lap joint.

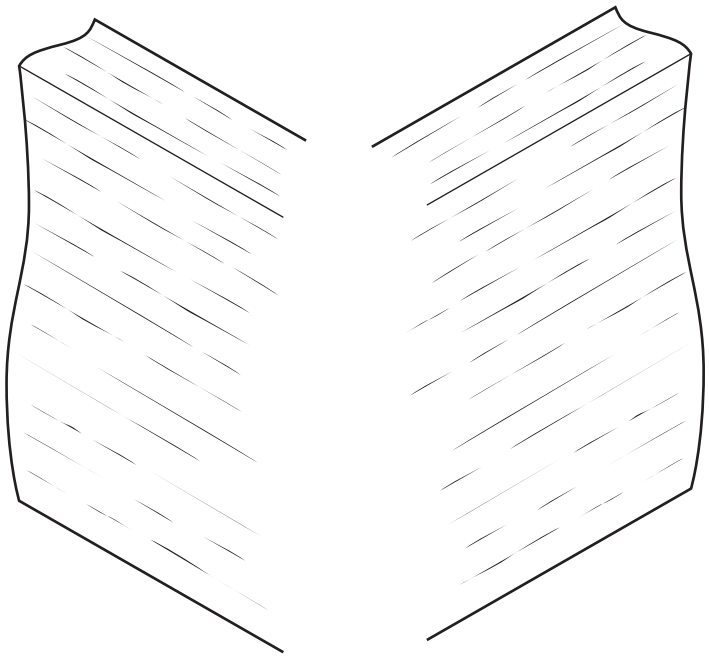

Fig. 4.1

Complete Fig. 4.1 to show a half-lap joint. [3]

5 Fig. 5.1 shows a toy fire engine.

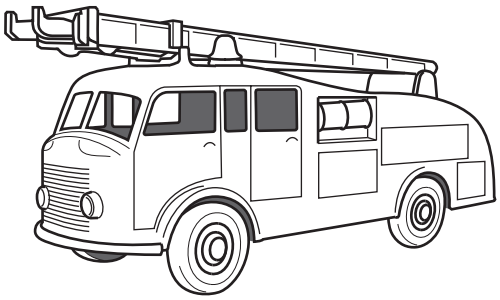

Fig. 5.1

Name a process that could be used to manufacture the toy fire engine when made from:

(a) zinc based alloy

..... [1]

(b) ABS.

..... [1]

6 Fig. 6.1 shows a tool being used to measure the diameter of a metal rod.

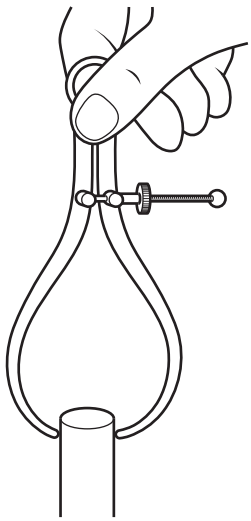

Fig. 6.1

(a) Name the tool shown in Fig. 6.1.

..... [1]

(b) Use sketches and notes to show how the actual measurement made by the tool would be read.

[2]

7 Fig. 7.1 shows the casing of a television remote control made from moulded plastic.

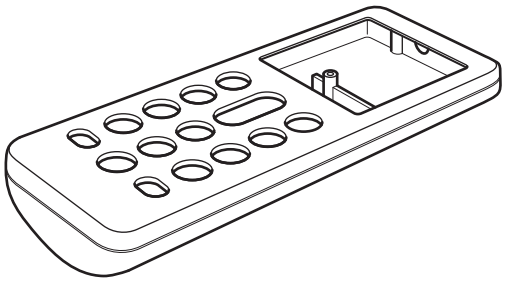

Fig. 7.1

Give **two** quality control checks that could be carried out **after** the casing has been manufactured.

1 .....

2 .....

[2]

8 Fig. 8.1 shows views of a bracket made from 1.6 mm thick mild steel sheet.

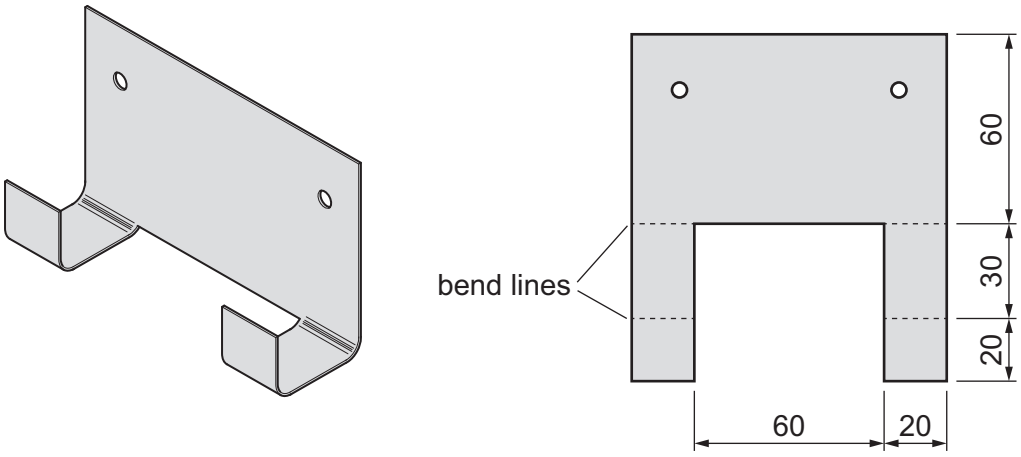

Fig. 8.1

Use sketches and notes to show how the mild steel sheet could be bent to shape.

[3]

9 Fig. 9.1 shows a rechargeable wind-up radio.

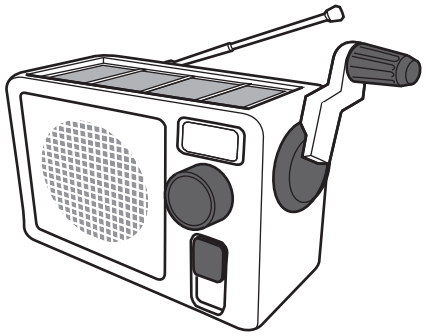

Fig. 9.1

Describe **two** ways in which the designer has considered ergonomics in the design of the wind-up radio.

1 .....

.....

2 .....

.....

[4]

10 Fig. 10.1 shows a length of hardwood that needs to be planed.
The hardwood is only 6 mm thick and could **not** be held securely in a woodworker's vice.

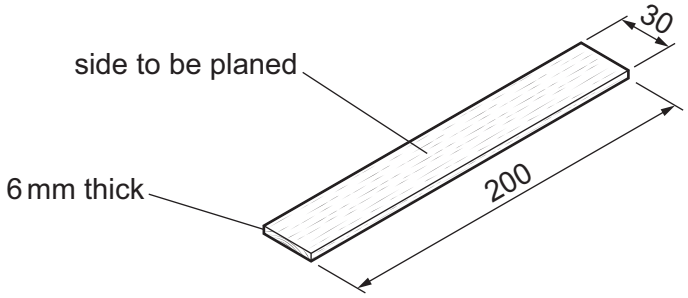

Fig. 10.1

Use sketches and notes to show how the hardwood could be held securely while it is planed.

[3]

Section B

Answer **one** question from this section.

11 Fig. 11.1 shows an incomplete design for scales and weights that could be used by children. A parts list gives details of the materials used and their sizes.

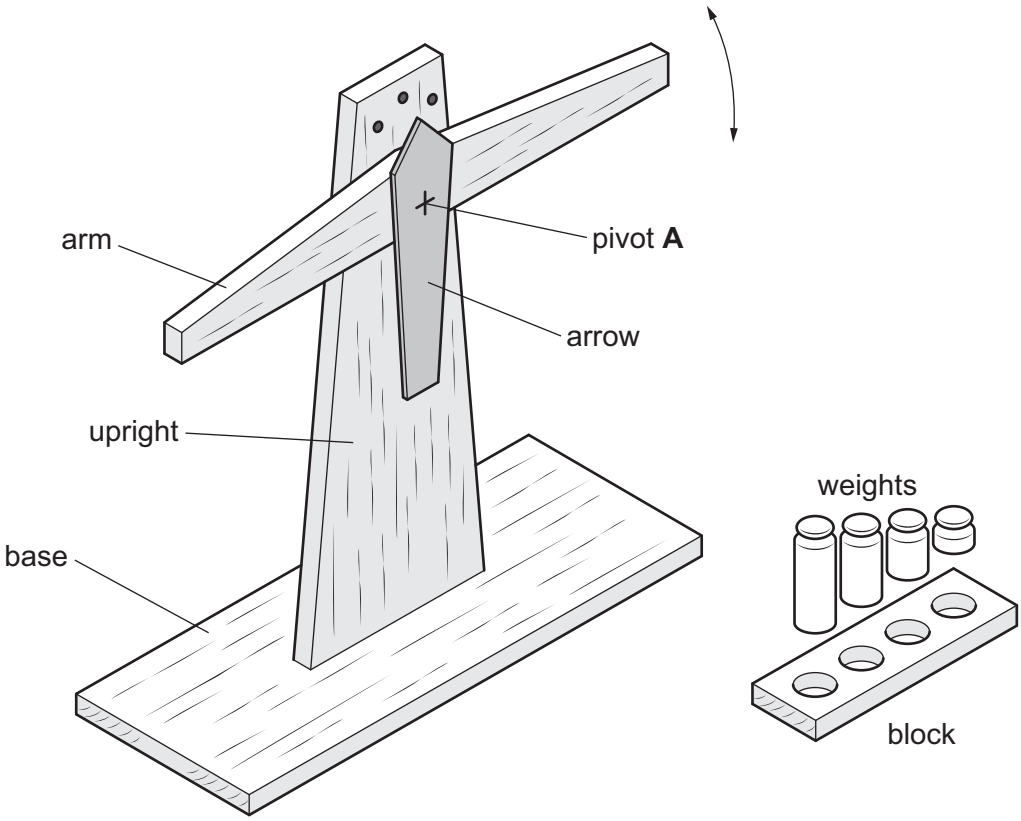

Fig. 11.1

Parts List

Part	length x width x thickness	Material
base	400 × 150 × 15	beech
upright	400 × 150 × 15	beech
arm	420 × 60 × 15	beech
arrow	210 × 50 × 5	MDF
block	195 × 60 × 20	beech
weights	Ø25	aluminium

(a) Give **two** reasons why beech is often used to make school equipment used by children.

1 .....

2 .....

[2]

(b) Sketch and name a suitable joint that could be used to join the upright to the base.

Name of joint .....

[4]

(c) Fig. 11.2 shows the shape of the arrow marked out on MDF.

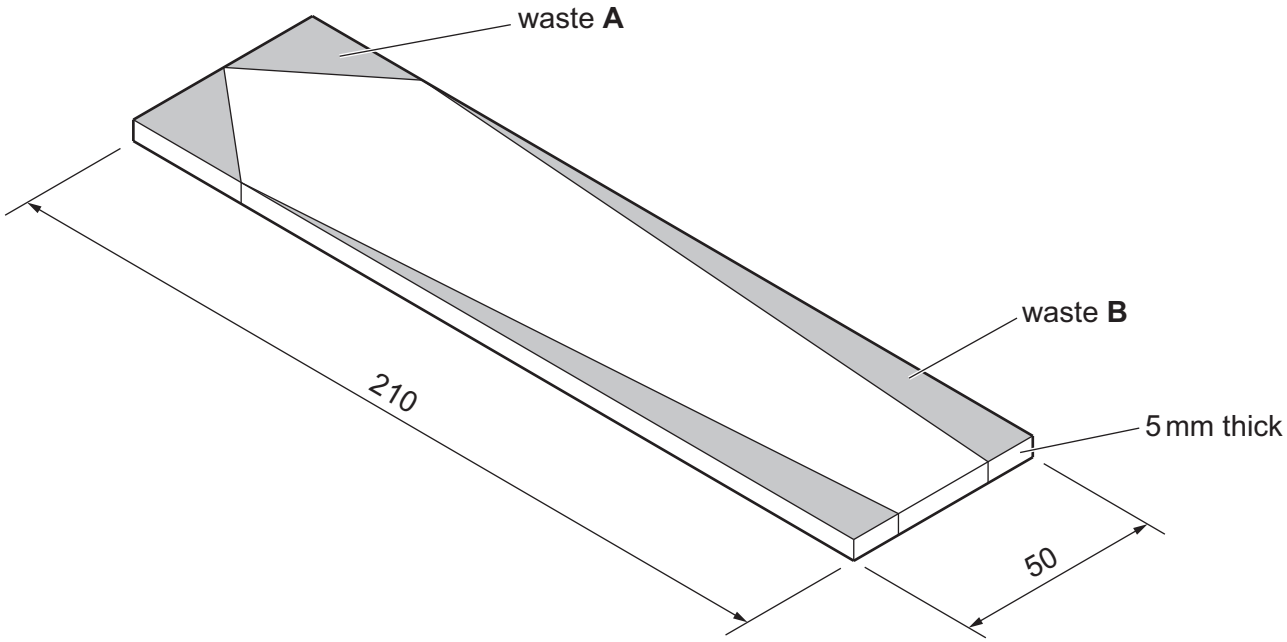

Fig. 11.2

(i) Name a machine saw that could be used to remove the waste.

..... [1]

(ii) After the waste has been removed at **A** the sawn edge will be made flat and smooth by using a disk sander.
State **one** safety precaution that must be taken when using a disk sander.

..... [1]

(iii) Fig. 11.3 shows a woodworker's vice.
After the waste has been removed at **B** the sawn edge will be made flat and smooth by using a bench plane.

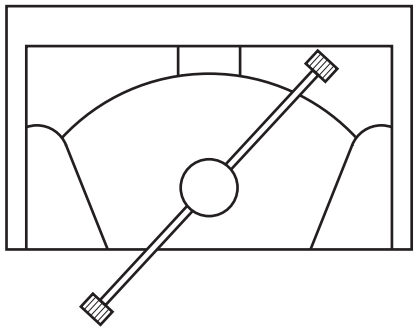

Fig. 11.3

Add a sketch to Fig. 11.3 to show how the MDF arrow could be held in the vice so that the sawn edges could be planed flat and smooth. [1]

(iv) Name a suitable bench plane that could be used to make the sawn edge flat and smooth.

..... [1]

(d) (i) A contact adhesive could be used to join the arrow to the arm of the scales.
Give **one** advantage of using a contact adhesive rather than PVA.

..... [1]

(ii) State **one** safety precaution that must be taken when using a contact adhesive.

..... [1]

(iii) Use sketches and notes to show how the arm, with the arrow attached, could be joined to the upright at pivot **A** and allowed to move as shown in Fig. 11.1.

[3]

(e) Fig. 11.4 shows the block, made of beech, that is used to store the four weights.

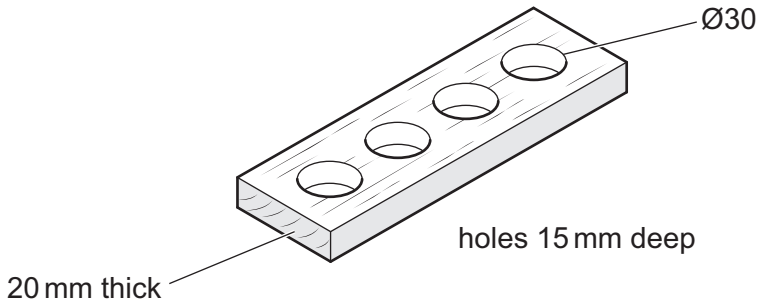

Fig. 11.4

(i) Name a specific type of drill bit that could be used to drill holes to a depth of 15 mm.

..... [1]

(ii) Describe a method that would ensure the holes are drilled to a depth of exactly 15 mm.

.....

.....

..... [2]

(f) Fig. 11.5 shows the scales with two pans that will be attached to the arm.

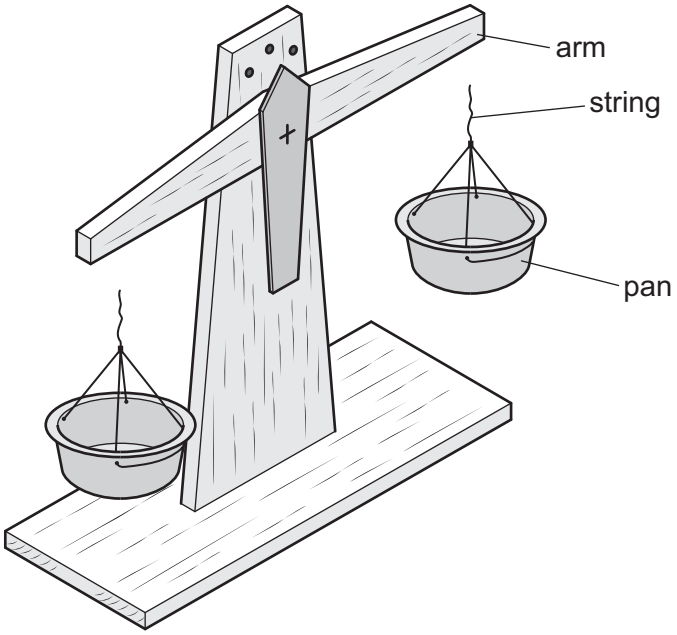

Fig. 11.5

Fig. 11.6 shows details of one of the pans that will be used to hold the metal weights and the mould that will be used to vacuum form the pans.

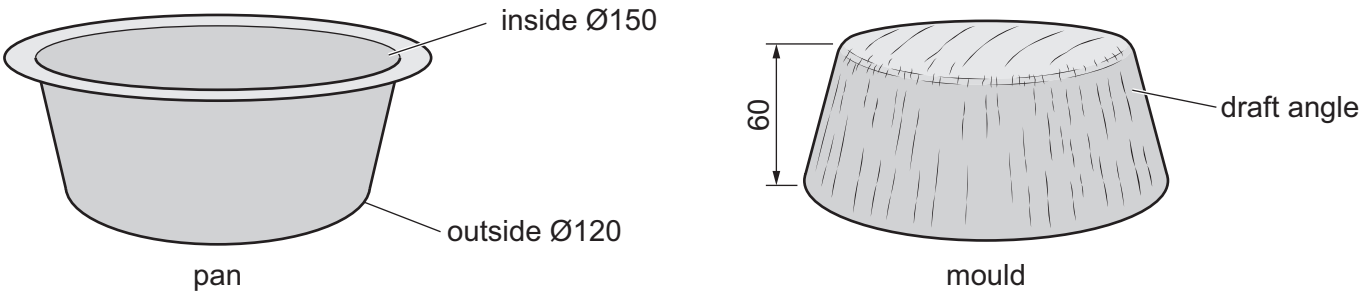

Fig. 11.6

(i) Explain the purpose of the draft angle on the mould.

.....

.....

..... [2]

(ii) Fig. 11.7 shows a sectional view through part of a vacuum forming machine.
Add sketches to Fig. 11.7 to show the mould, the heater and the plastic sheet in position ready to vacuum form one pan.

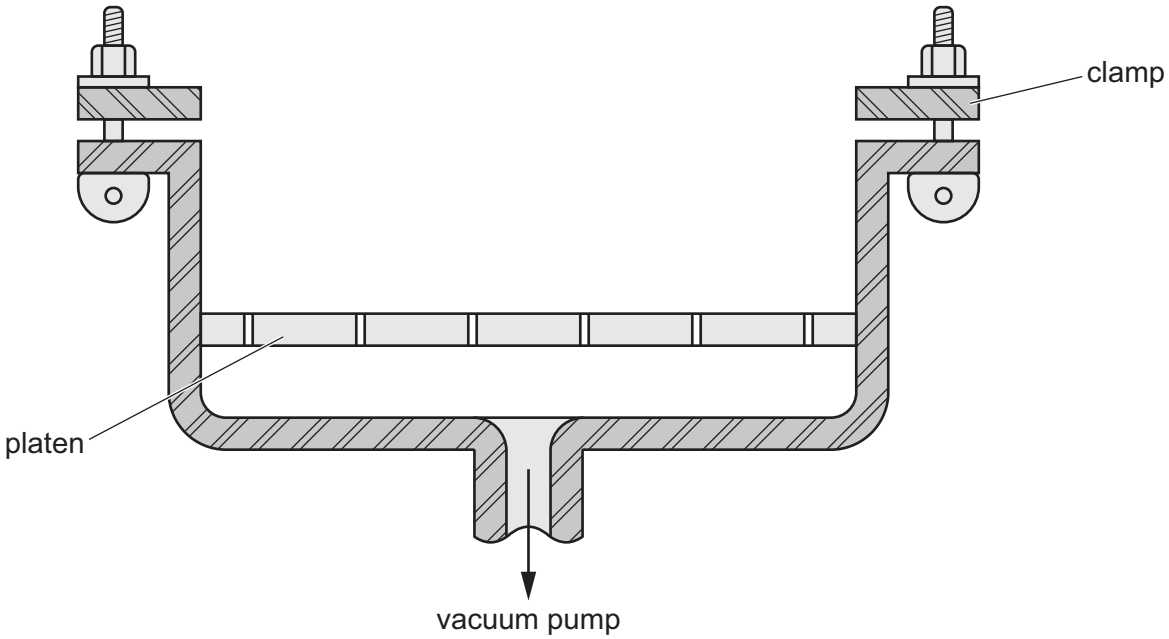

Fig. 11.7

[3]

(g) Fig. 11.8 shows one of the pans ready to be attached to the arm of the scales.

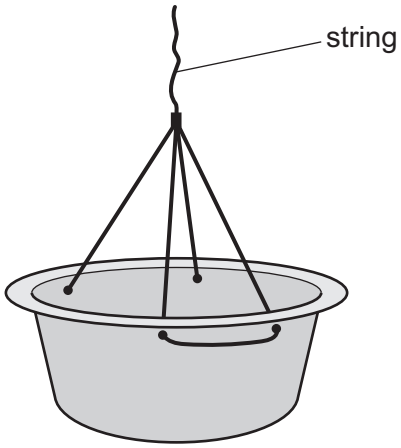

Fig. 11.8

Use sketches and notes to show how one pan could be attached to the arm of the scales. The method of attachment must allow the pan to be removed.

[2]

12 Fig. 12.1 shows a holder to store a gaming controller and a headset.
The holder is made from MDF.

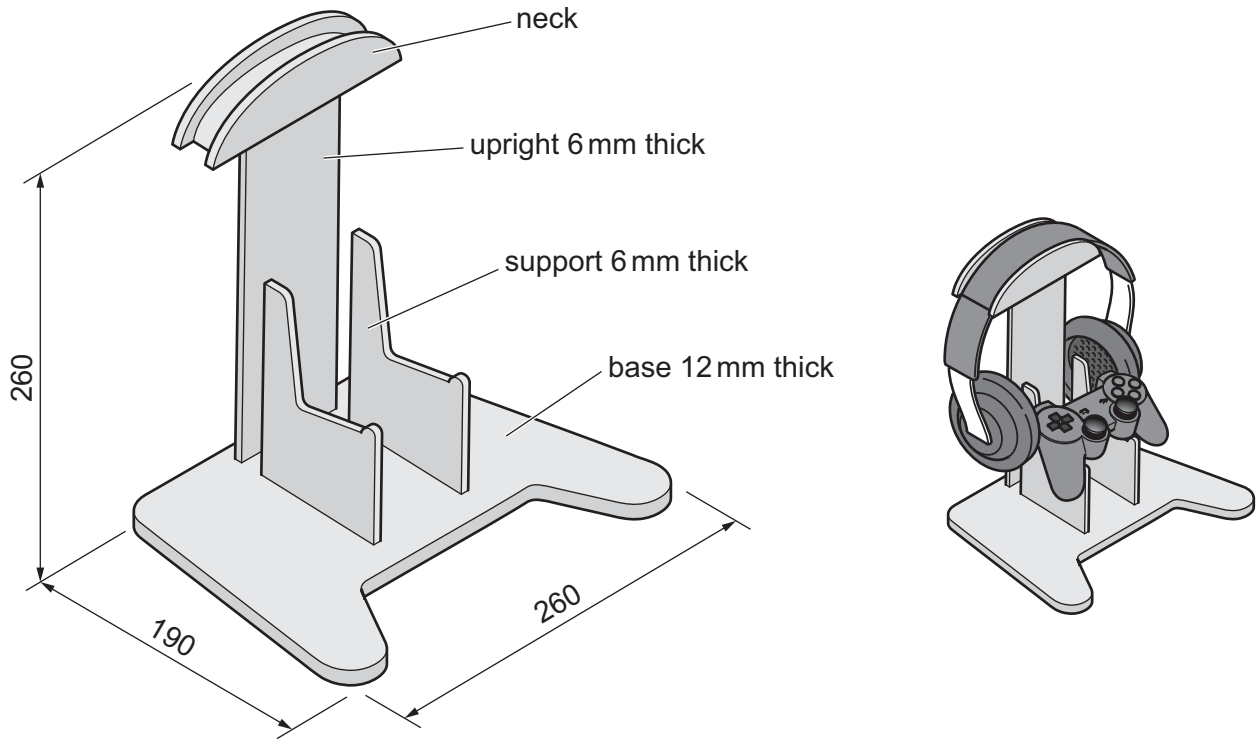

Fig. 12.1

(a) Give **two** items of research a designer would need to consider when designing the holder for the gaming controller and headset.

1 .....

2 .....
[2]

(b) The holder could be made from MDF or plywood.
Give **two** advantages of using MDF to make the holder rather than plywood.

1 .....

2 .....
[2]

(c) Fig. 12.2 shows a template that could be used to mark out the shape of the base and the positions for joining the upright and supports to the base.

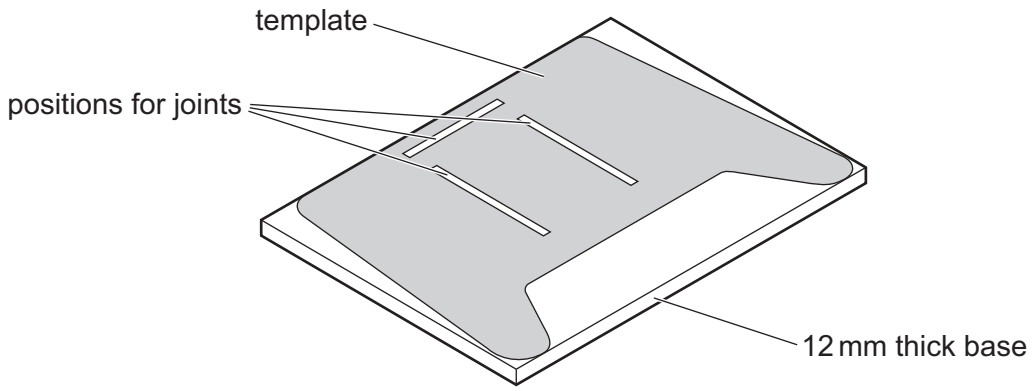

Fig. 12.2

(i) Give **one** benefit of using a template to mark out the base and positions for the joints.

..... [1]

(ii) State **one** advantage of making a template from thin sheet metal rather than card when making a batch of holders.

..... [1]

(iii) Give the names of **two** different saws that could be used to cut out the shape of the base.

1 .....

2 .....

[2]

(d) The upright and supports will be joined to the base in the positions shown in Fig. 12.2.
Use sketches and notes to show how the upright could be joined to the base.

[3]

(e) Fig. 12.3 shows an exploded view of three pieces of MDF that will be glued together to make the neck of the holder.

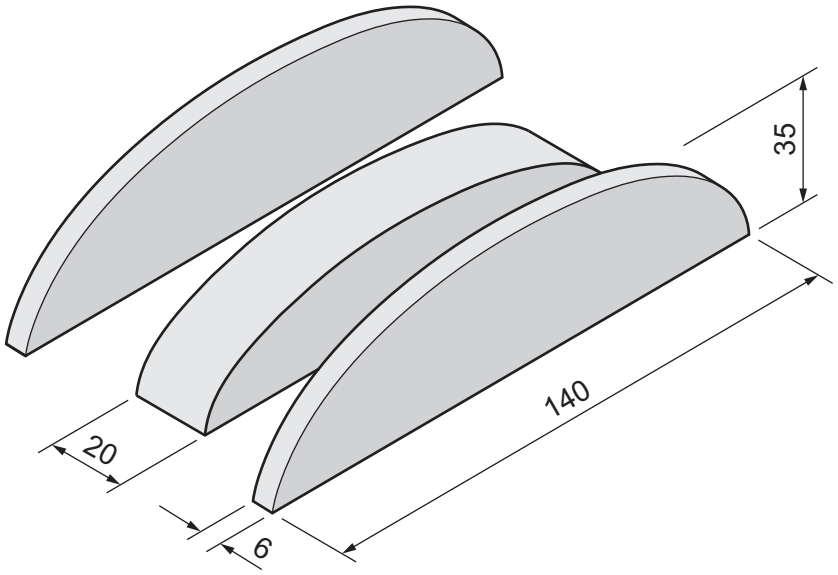

Fig. 12.3

Use sketches and notes to show how the three pieces of MDF could be glued and clamped together accurately and securely to make the neck of the holder.
Include the following details:

- the name of a suitable adhesive
- the method of clamping used
- **two** checks that would be carried out after the pieces have been glued and clamped.

[6]

(f) The parts of the holder will be painted **before** they are assembled.

(i) The surfaces of the MDF will be sanded using a fine grade glasspaper wrapped around a cork sanding block.
Give **one** benefit of using a cork sanding block with the glasspaper.

..... [1]

(ii) A primer coat of paint will be applied to the MDF.
Describe the purpose of a primer coat.

.....

..... [2]

(iii) The final coat of paint will be sprayed onto the surfaces.
Give **one** advantage of spraying the paint rather than by using a brush.

..... [1]

(iv) State **one** safety precaution that must be taken when spray painting.

..... [1]

(g) Explain how an evaluation of the final product could be carried out.

.....

.....

.....

..... [3]

13 Fig. 13.1 shows an incomplete design for a wall-mounted adjustable shelving unit.

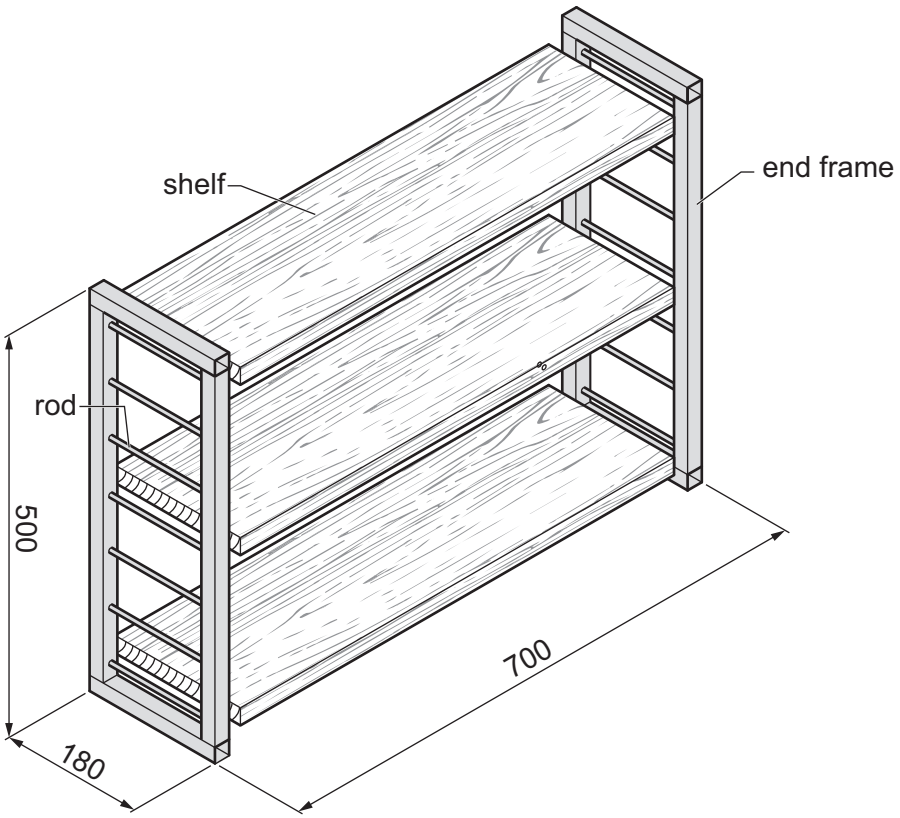

Fig. 13.1

Parts List

Part	Number required	Material and sizes
end frames	2	mild steel square tube 20 × 20
rods	14	mild steel round tube Ø10
shelves	3	veneered chipboard 18 thick

(a) Give **two** benefits of using veneered chipboard for the shelves.

1 .....

2 .....

[2]

(b) There are 14 lengths of Ø10 mild steel tube used to make the end frames.
Use sketches and notes to show a design for a jig that could be used when sawing each of the Ø10 mild steel tubes to a length of 170 mm.
Name the material from which the jig is made and state the name of an appropriate saw that could be used.

[4]

(c) Fig. 13.2 shows two lengths of mild steel tube that will be joined at the corner of one end frame.

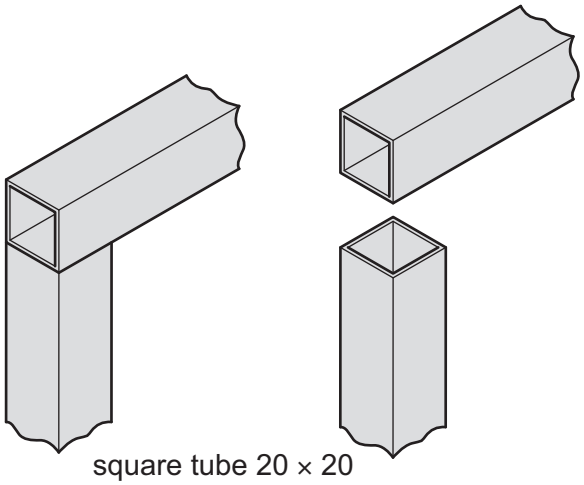

Fig. 13.2

(i) The mild steel tube will be joined by brazing.
Name **two** abrasives that could be used to clean the joint before the mild steel tube is brazed.

1 .....

2 .....

[2]

(ii) Flux will be applied to the joint before the mild steel tube is heated.
Explain the purpose of the flux.

.....

.....

..... [2]

(iii) The 'open' ends of the mild steel tube are unattractive.
Use sketches and notes to show how the appearance of the open end of the tube could be improved. Name any materials used.

[3]

(d) Fig. 13.3 shows details of one of the brackets that will allow the adjustable shelf unit to be fixed to a wall. The brackets, made from mild steel sheet, fit around the mild steel tube when the parts of the end frames are assembled.

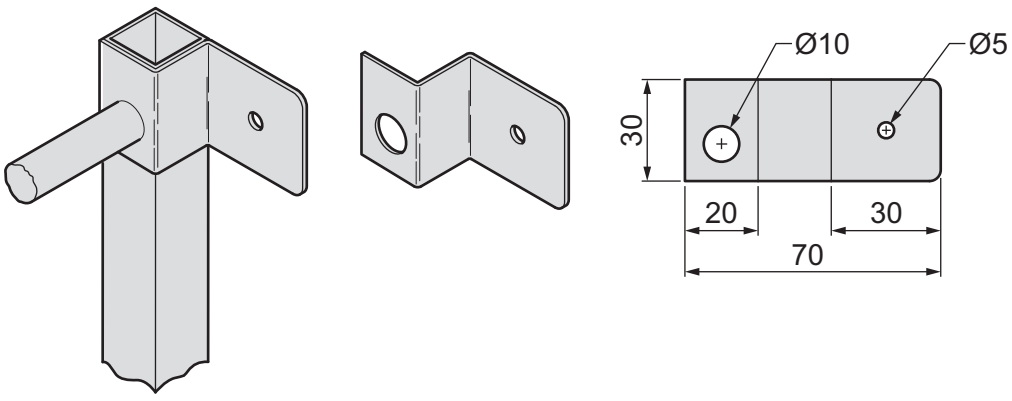

Fig. 13.3

(i) Name **two** marking out tools that could be used to mark out the centres for the Ø10 and Ø5 holes.

1 .....

2 .....

[2]

(ii) Use sketches and notes to show how the mild steel sheet could be bent to the shape of the bracket. Name all the tools and equipment used.

[4]

(iii) Some metals need to be made softer so they can be bent more easily.
A list of processes used with metal is given below.

quenching **tempering** **alloying** **annealing**

Circle from the list the process that is used to make a metal softer. [1]

(e) Fig. 13.4 shows the position of the end of a shelf and an end frame.
There is a gap of 20 mm between the end of the shelf and the 20 × 20 square tube.

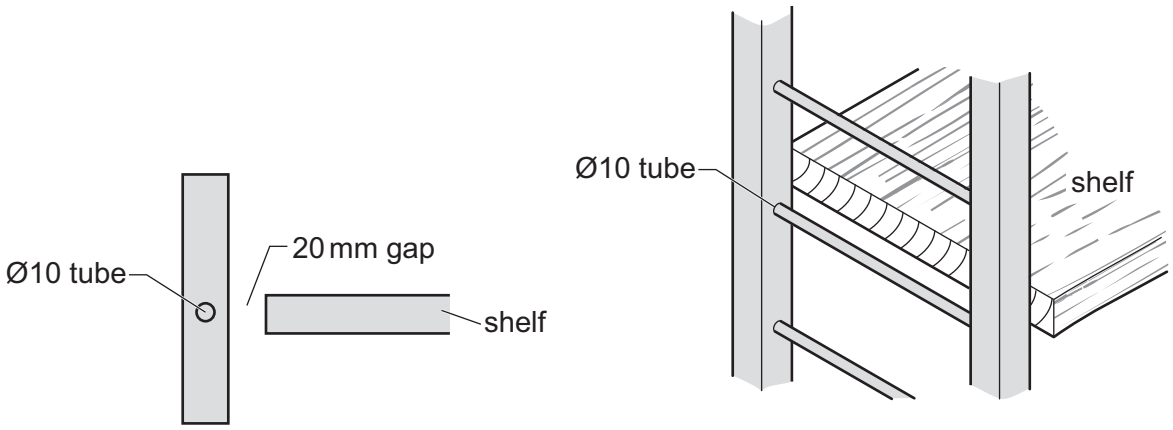

Fig. 13.4

Use sketches and notes to show how the shelf could be supported by the Ø10 tubes.
The method of support must be strong enough to hold a variety of products that could be placed on the shelf.
Include the following details:

- the material from which the method of support is made
- constructional details
- **one** important size.

[5]

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