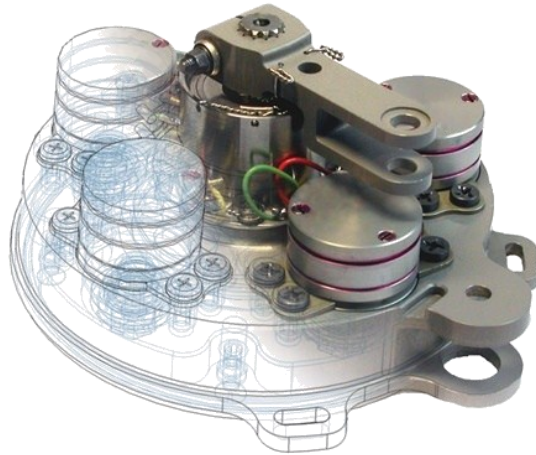


Design and Manufacture



National 4/5

Theory homework

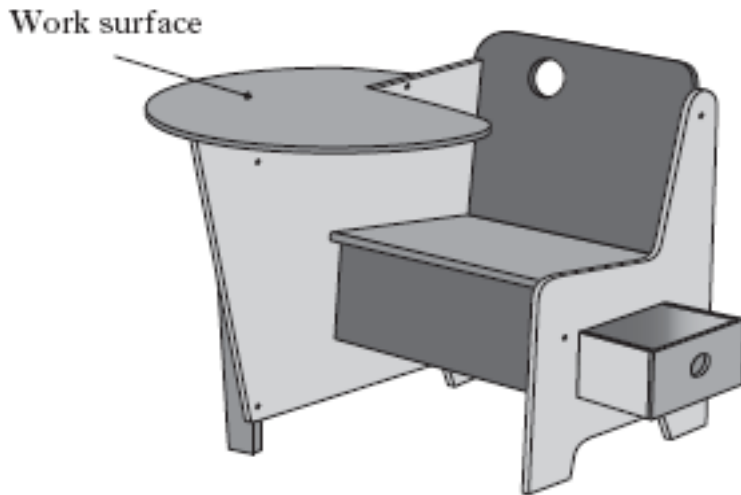


Wood questions



1

A child's desk made from plywood is shown below.



(ii) Plywood is a manufactured board.

Describe how plywood is constructed to give it strength. Sketches may be used.

The circular work surface was cut out using a **machine** saw.

State the name of a suitable **machine** saw.

Knock down fittings were used in the assembly of the desk.

State **one** advantage of using knock down fittings over traditional joints.

Two colours of paint were used in the finishing of the desk.

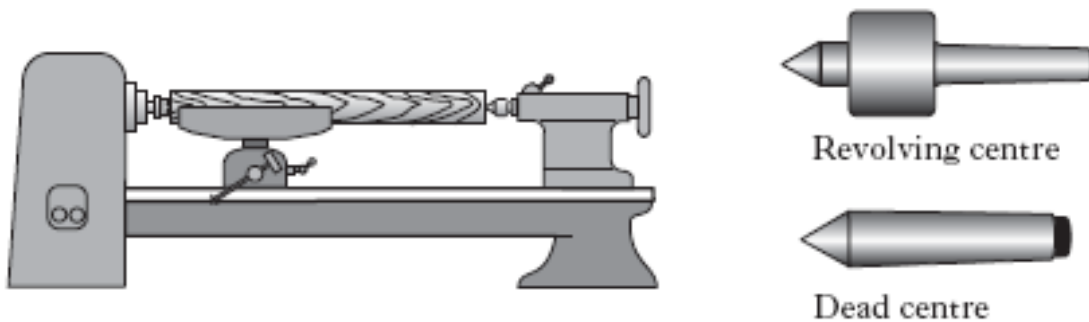
State a method that would prevent the colours from running together.

2

A wooden kitchen utensil is shown below.



(a) The utensil was manufactured on the machine shown below.



(i) State **one** advantage of using a revolving centre instead of a dead centre.

(ii) State the name of the tool used to turn the blank into a cylinder.

(iii) State the name of the tool used to check the diameters when turning.

(b) The utensil was sanded before removal from the wood lathe.

State **two** adjustments that should be carried out before sanding.

1 _____

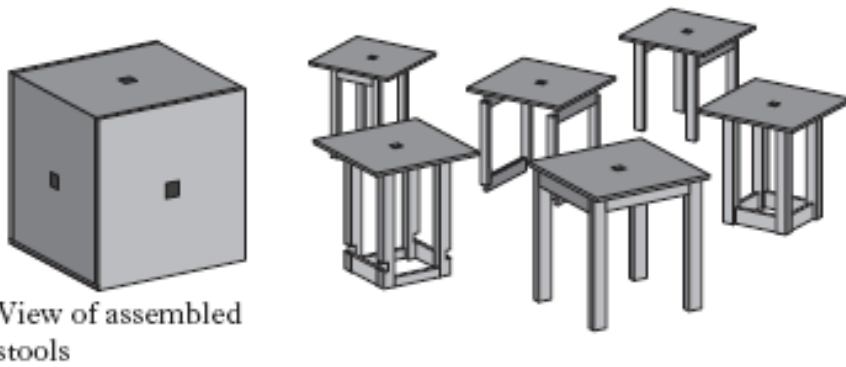
2 _____

(c) Vegetable oil was applied as a finish to the utensil.

State a reason why this type of finish is important.

3

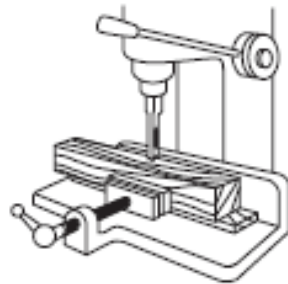
The stools shown below can be assembled to form a cube.



View of assembled stools

(a) State a functional reason for the square hole on the top of each stool.

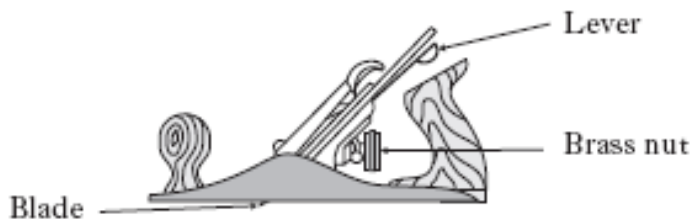
(b) The machine shown below was used during the manufacture of the stools.



State the name of this machine.

Name of machine _____

(c) The plane shown below was used during the manufacture of the stools.



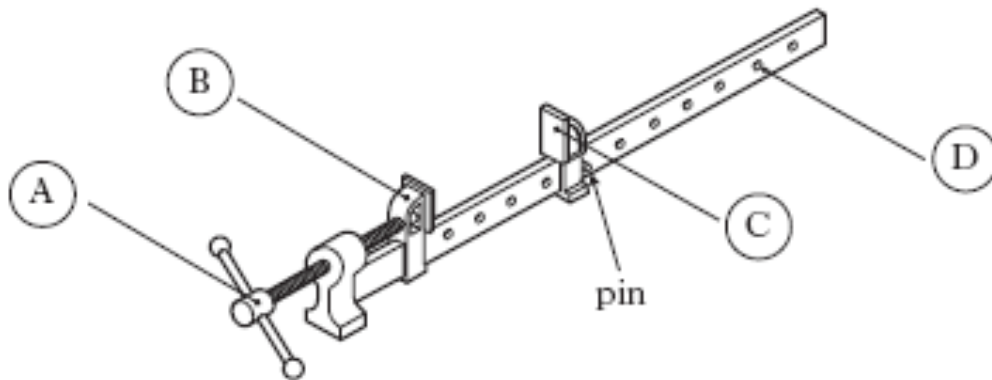
State the effect of the following on the blade.

(i) Turning the brass nut _____

(ii) Adjusting the lever _____

**3
contd**

(d) The sash cramp shown below was used during the manufacture of the stools.

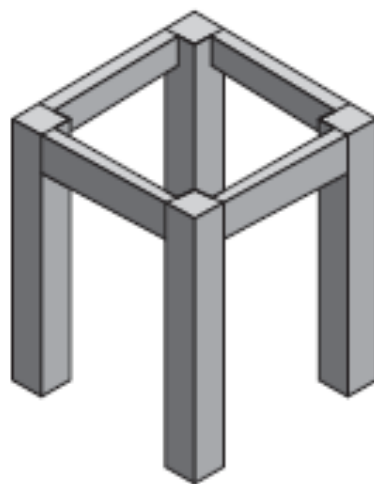


State **two** adjustments that could be made to this tool.

Adjustment 1 _____

Adjustment 2 _____

(e) A stool frame is shown below.



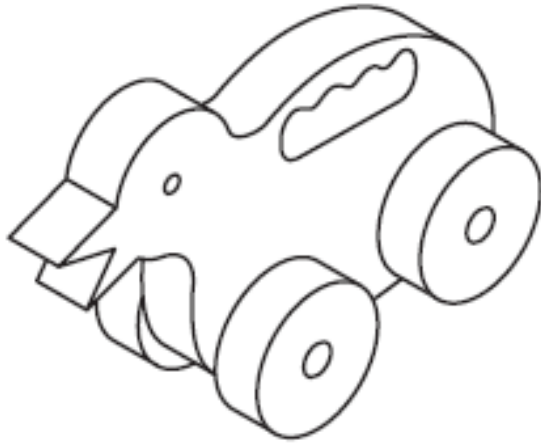
State **two** methods of ensuring the frame is “square”.

1 _____

2 _____

4

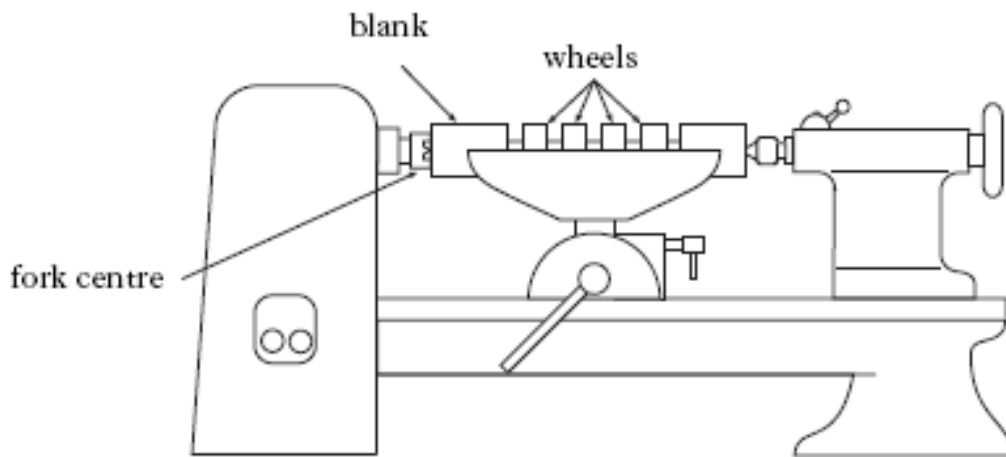
A hand held toy is shown.



- (a) The toy was made from a light coloured, close grained hardwood.

State the name of a suitable hardwood.

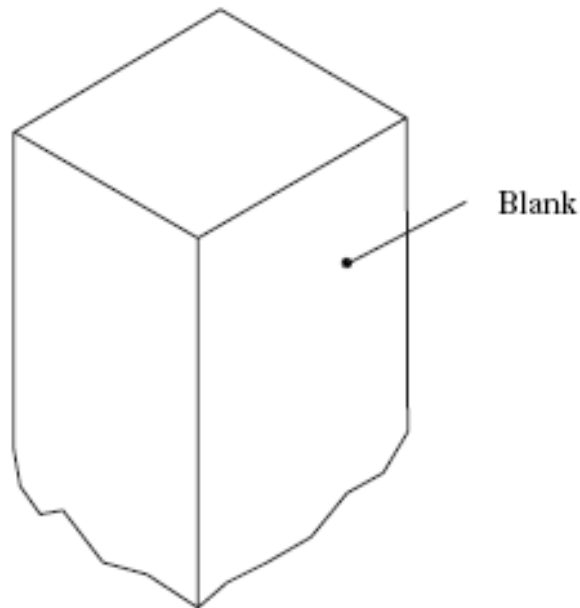
- (b) The four wheels were made using the wood lathe as shown.



- (i) State a reason why the blank is longer than the combined width of the four wheels.

4
contd

- (ii) On the sketch show how the end of the blank is prepared for fixing to the fork centre.

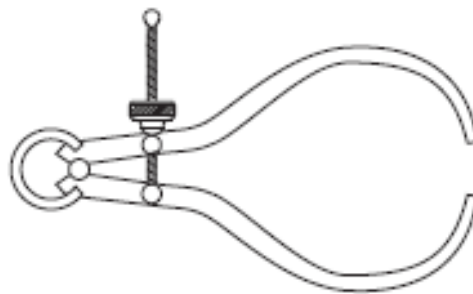


- (iii) State the name of **two** turning tools used during the manufacture of the wheels.

Tool 1 _____

Tool 2 _____

- (iv) The following tool was used during the manufacture of the wheels.



State the name of this tool and describe its purpose.

Name _____

Purpose _____

4
contd

(v) The wheels were sanded before removal from the wood lathe. State two adjustments that should be carried out before sanding.

1 _____

2 _____

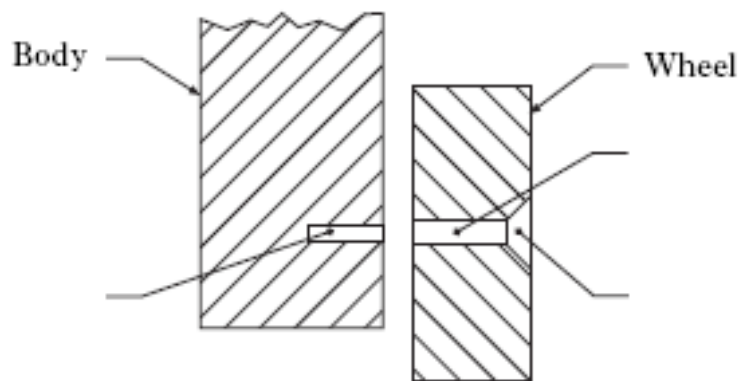
(c) The three holes listed were drilled in preparation for fixing the wheels to the body using wood screws.

Countersink

Pilot

Clearance

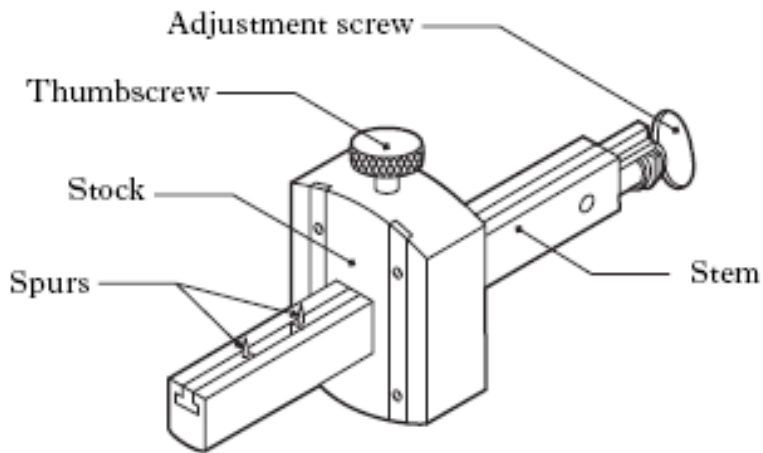
Label the holes on the sketch using the list above.



(i) Pine and hardwoods were considered for the frame of the chair. Explain why the use of pine is considered more environmentally friendly than the use of a hardwood.

5

(i) The tool shown below was used in the manufacture of the chair.



State the name of the tool.

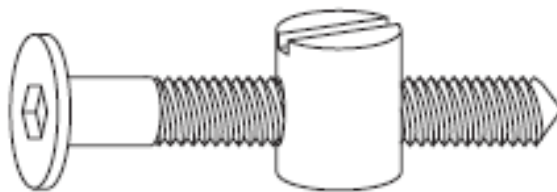
Tool _____

(ii) Describe two adjustments that could be made to this tool.

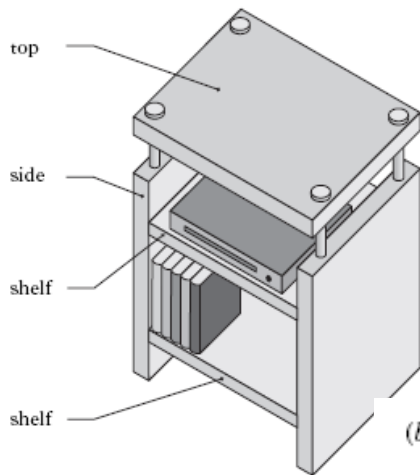
1 _____

2 _____

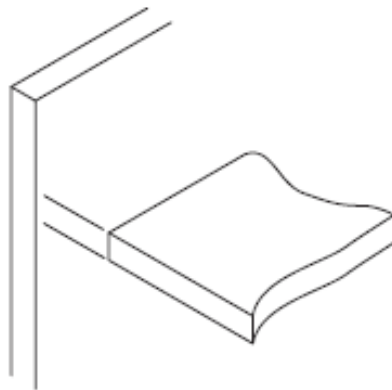
The fixing shown below was used during the manufacture of the chair.



State the name of this type of fixing.

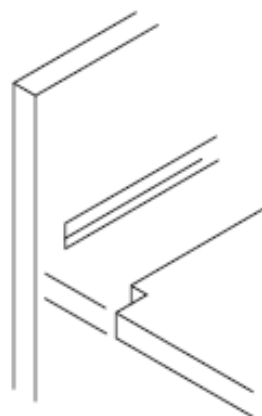


(b) A butt joint was considered for the unit as shown below.



State a reason why this joint was rejected.

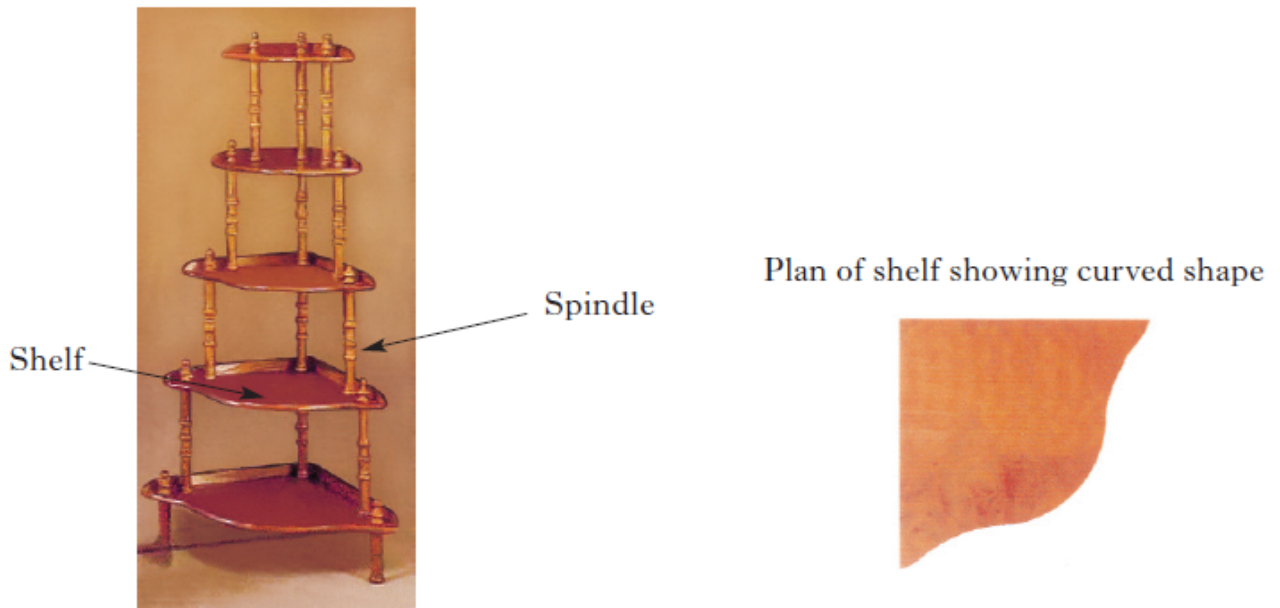
(c) The joint shown below was used to join the shelves to the sides.



(i) State the name of this joint.

(ii) State an aesthetic reason for using this joint.

6 The corner-shelving unit shown below is constructed from hardwood and is sold as a flat-pack.



- (a) (i) State the name of a suitable manufacturing process for the spindles. **1**
- (ii) Describe a method of joining the spindles to the shelves. **2**
(Sketches may be used to illustrate your answer.)
- (iii) State the name of a power tool which could have been used to produce the curved shape of the shelves. **1**
- (b) State **two disadvantages** to the **consumer** of flat-packed furniture. **2**
- (c) State **two** reasons why using a softwood would be more environmentally friendly than using a hardwood. **2**
- (d) State the name of **two** suitable finishes that could be applied to the hardwood. **2**
- (10)**

7 The computer desk shown below was supplied as a flat-pack.



- (a) State **two advantages** to the **consumer** of flat-packed furniture. 2
- (b) State **two advantages** of using beech veneered chipboard for the computer desk rather than using solid beech. 2
- (c) Knock down fittings are often used in the construction of flat-packed furniture. 1

Explain the term “knock down fittings”.

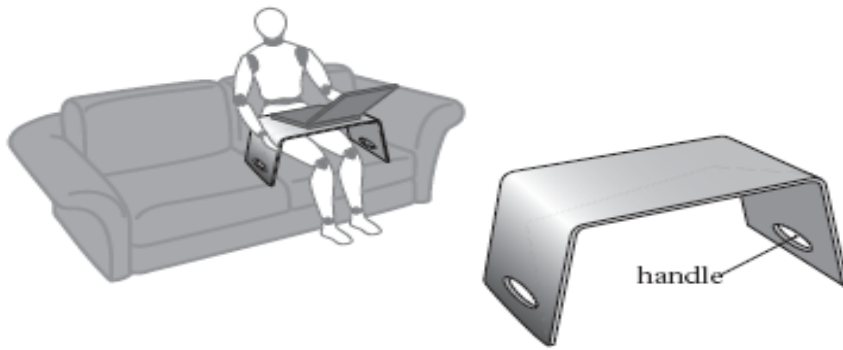
(5)

Factors that influence design



1

A portable laptop table made from acrylic is shown below.



Enlarged view of laptop table

A variety of graphic techniques were used during the design of the laptop table.

(a) State the stage in the design process where the following graphics were used.

(i) Quick, rough sketches.

(ii) Dimensioned drawing showing details of construction.

(iii) Fully rendered 3D drawing.

(b) Data tables of human dimensions were used during the design of the laptop table.

(i) State the name of this type of data. _____

(ii) State **two** human dimensions which may be considered when designing the laptop table.

1 _____

2 _____

The laptop table was designed to suit a range of users.

(c) State the percentage of the population that should comfortably be able to use the laptop table.

During the design process a scale model of the laptop table was produced.

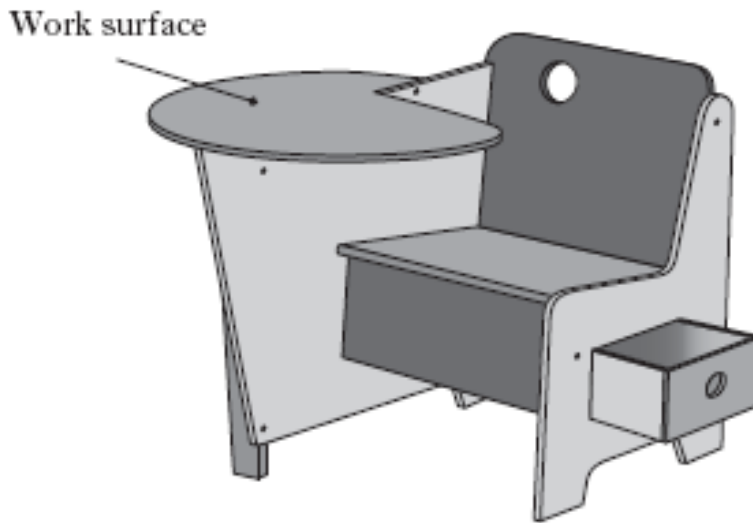
(d) State **two** reasons for producing a scale model.

1 _____

2 _____

2

A child's desk made from plywood is shown below.



- (a) The primary function of the desk is to provide a seat.
State **two** further functions of the desk.

1 _____

2 _____

- (b) Designers use various techniques to generate ideas.
Name **two** idea generating techniques.

1 _____

2 _____

- (c) A cutting list was produced.

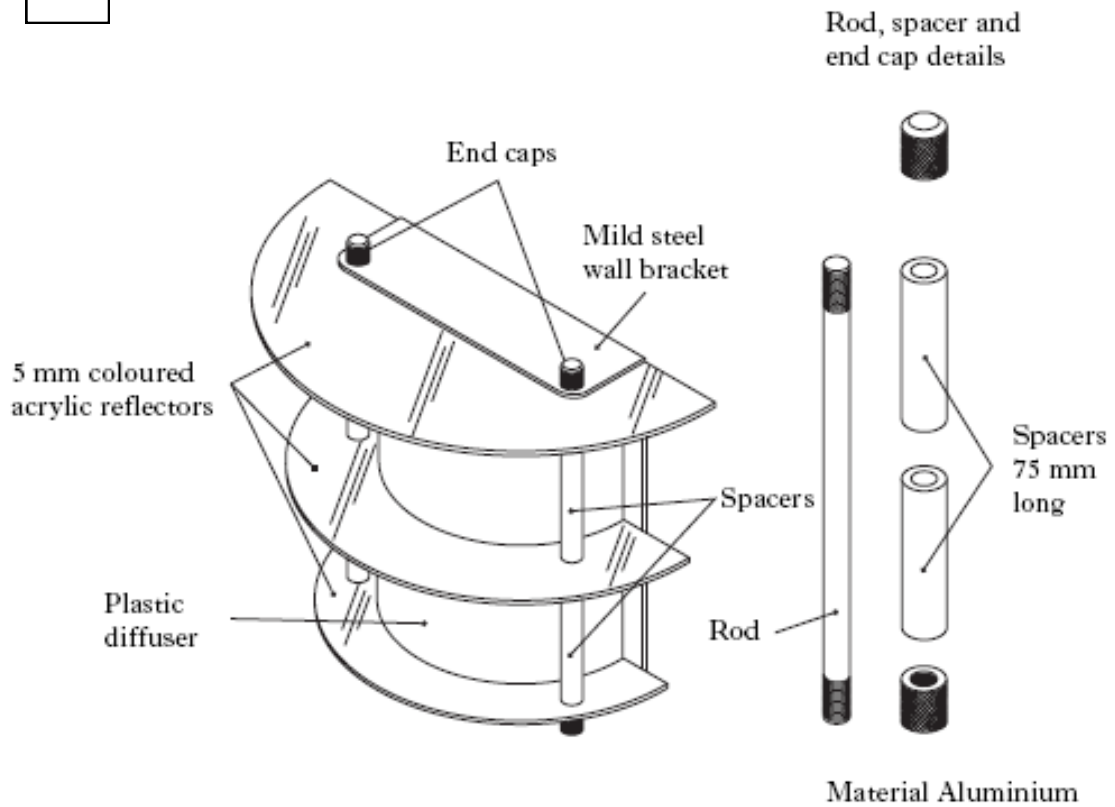
- (i) State **two** pieces of information other than sizes that could be found in a cutting list.

1 _____

2 _____

3

A wall light is shown.



- (a) (i) Colour was an area of aesthetics investigated during the design of the wall light.

State **two** further areas of aesthetics that may have been considered during the design of the wall light.

- 1 _____
- 2 _____

- (ii) Materials were also investigated during the design of the wall light.

State **two** reasons why the choice of material is important.

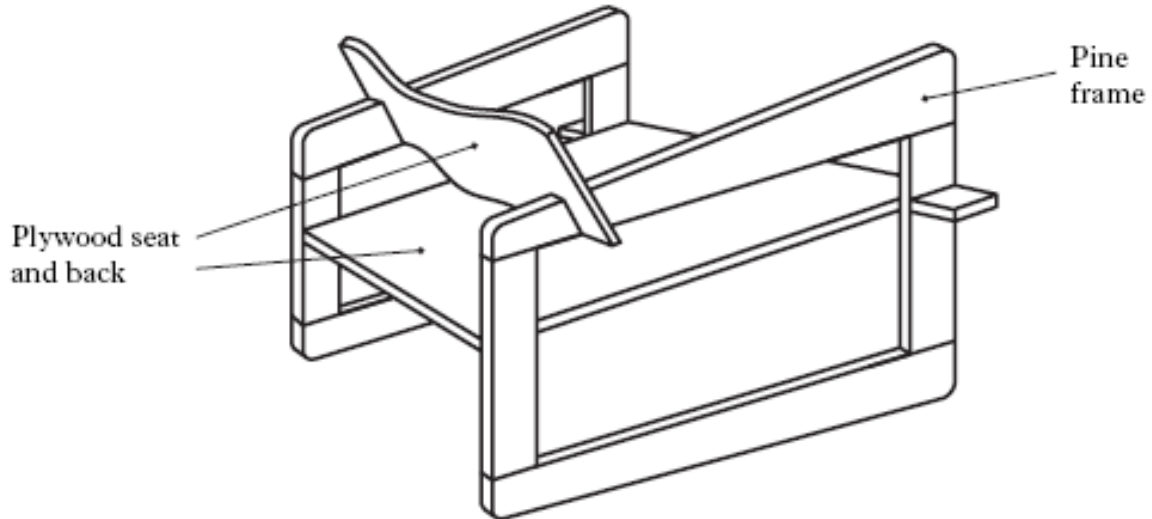
- 1 _____
- 2 _____

“The bulb must be easy to change” appeared in the specification for the wall light.

State the design factor being considered to ensure that the bulb can be easily changed.

4

A pupil's design for a chair is shown.



(a) (i) During the design of the chair a scale model was made.

State two reasons for producing a scale model.

Reason 1 _____

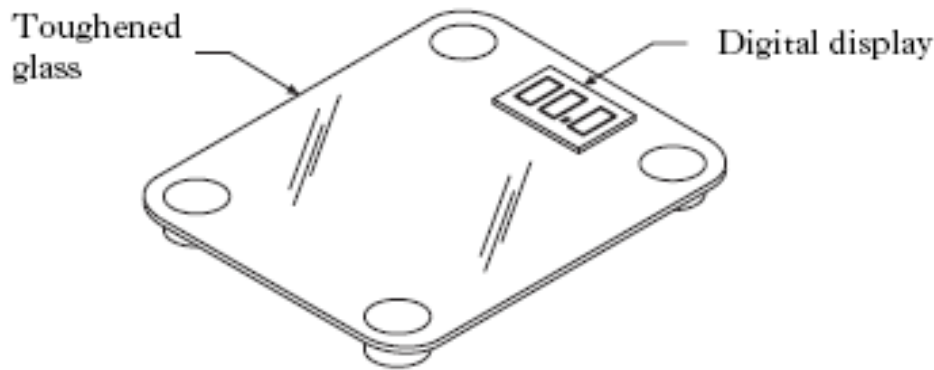
Reason 2 _____

(ii) An ergonomist was used during the design of the chair.

State what is meant by *an ergonomist*.

Bathroom scales are shown.

5



(a) **Ergonomics** was investigated during the design of the scales.

State what is meant by the term *ergonomics*.

(b) (i) The following table was referred to during the design of the scales.

	Adult males			Adult females		
	5 th % ile	50 th % ile	95 th % ile	5 th % ile	50 th % ile	95 th % ile
Foot length	240	260	285	215	235	255
Foot width	85	95	110	80	90	100

State the name of this type of data.

**5
contd**

This table refers to 5th, 50th and 95th percentiles.

State what is meant by:

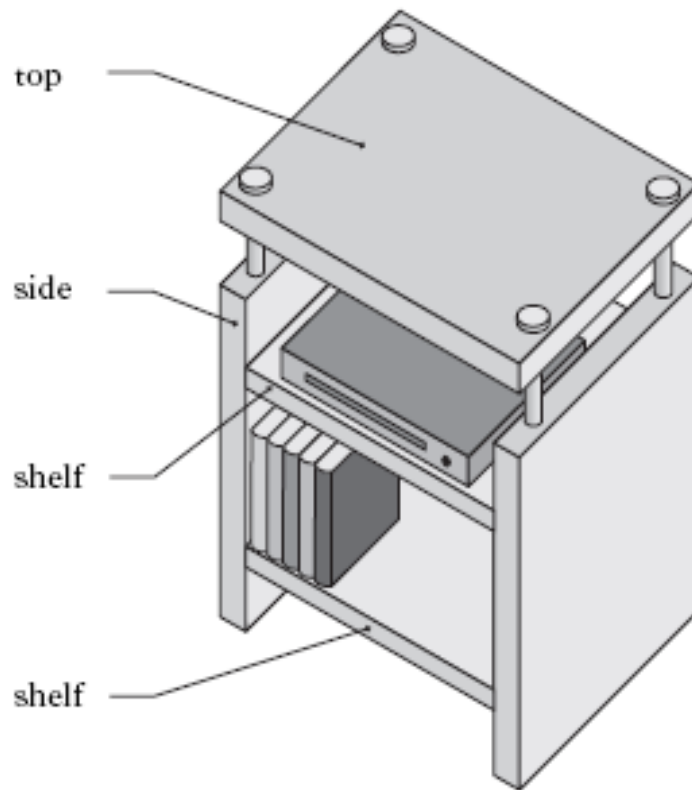
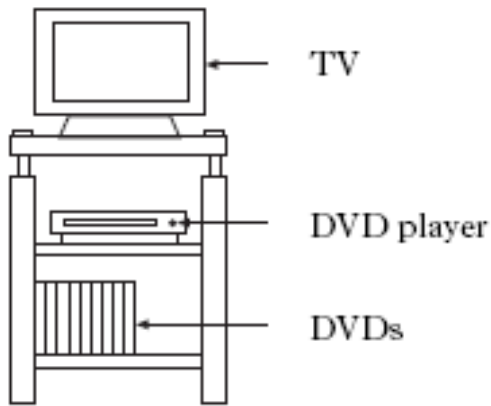
5th percentile

50th percentile

The 95th percentile sizes were considered to be important.

State why these are important.

6 A TV unit made from MDF is shown below.



(a) Materials were investigated during the design of the unit.

State **two** further design issues that could be investigated.

(i) _____

(ii) _____

7

Computer mice are shown below.



Before producing a specification for a computer mouse, the designer would have researched various design issues.

With reference to computer mouse design:

- (a) state **four** design issues which would have been researched;
- (b) explain why each of these design issues is important.

1
4
(5)

8

Two different styles of clock are shown below.



Clock A



Clock B

- (a) State a target market for **one** of the clocks shown and give a reason for your answer.
- (b) State which clock is likely to have been hand made and give **two** reasons for your answer.

2
3
(5)

9

A pocket multi-tool manufactured from stainless steel is shown below.



- (a) With reference to the above multi-tool, describe the difference between *primary* and *secondary functions*. 2
 - (b) Describe a technique that could be used to evaluate the *ease of use* of the multi-tool. 2
 - (c) Describe the *aesthetic* qualities of the multi-tool. 2
 - (d) State **two** reasons why the designer has chosen stainless steel for this product. 2
 - (e) State **two** methods of applying a coloured finish to the handles. 2
- (10)

10

During the design process, a professional designer will use various materials to build simple models.

- (a) State **two** reasons why the designer would build simple models. 2
 - (b) State the name of **two** materials that could be used to produce a simple model and explain why each material is suitable. 4
- (Note: a different explanation should be given for each material.) (6)

11

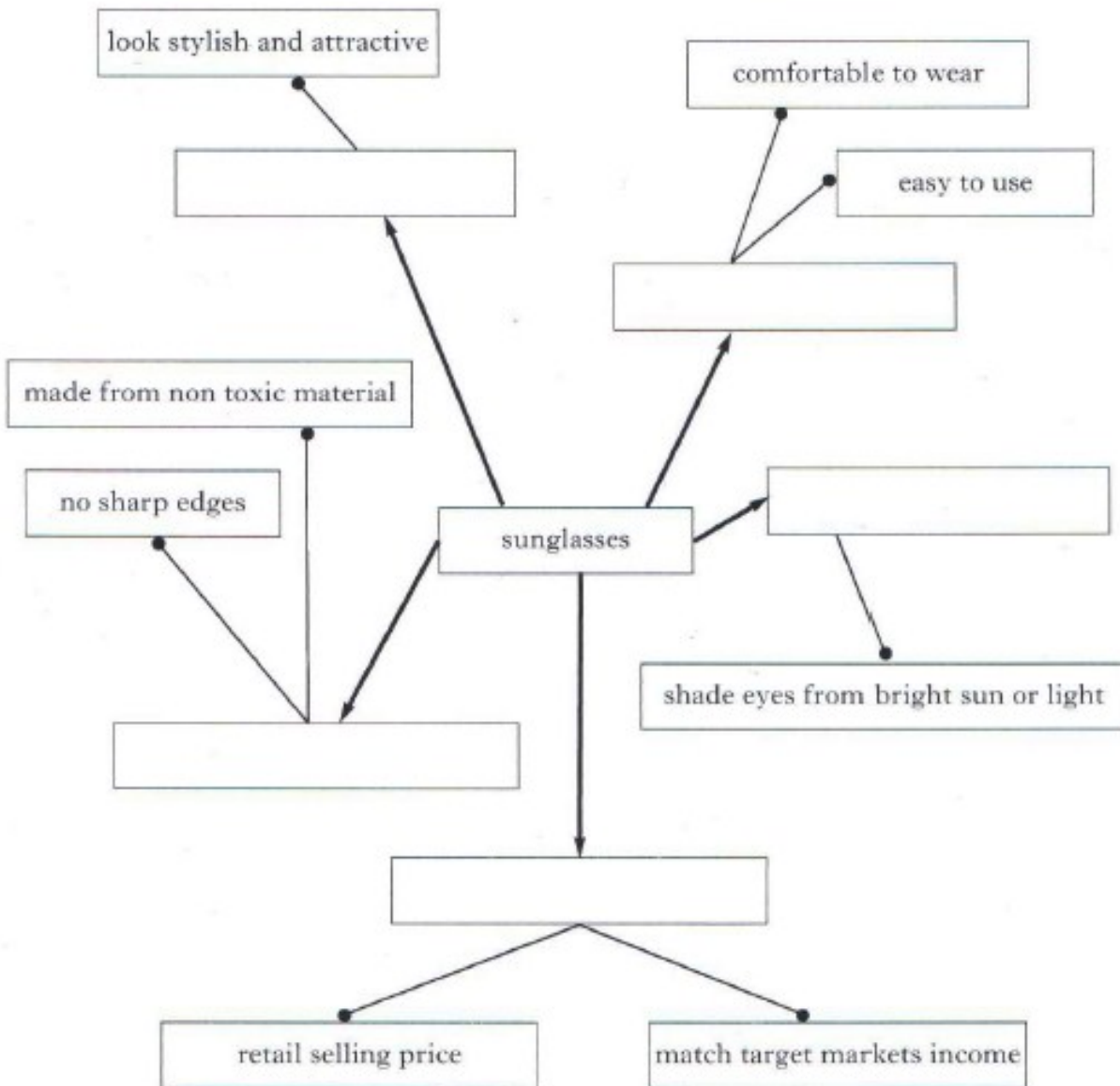
A designer has been asked to develop a new pair of sunglasses.



During the analysis the designer considered the following design factors.

Ergonomics Economics Safety Aesthetics Function

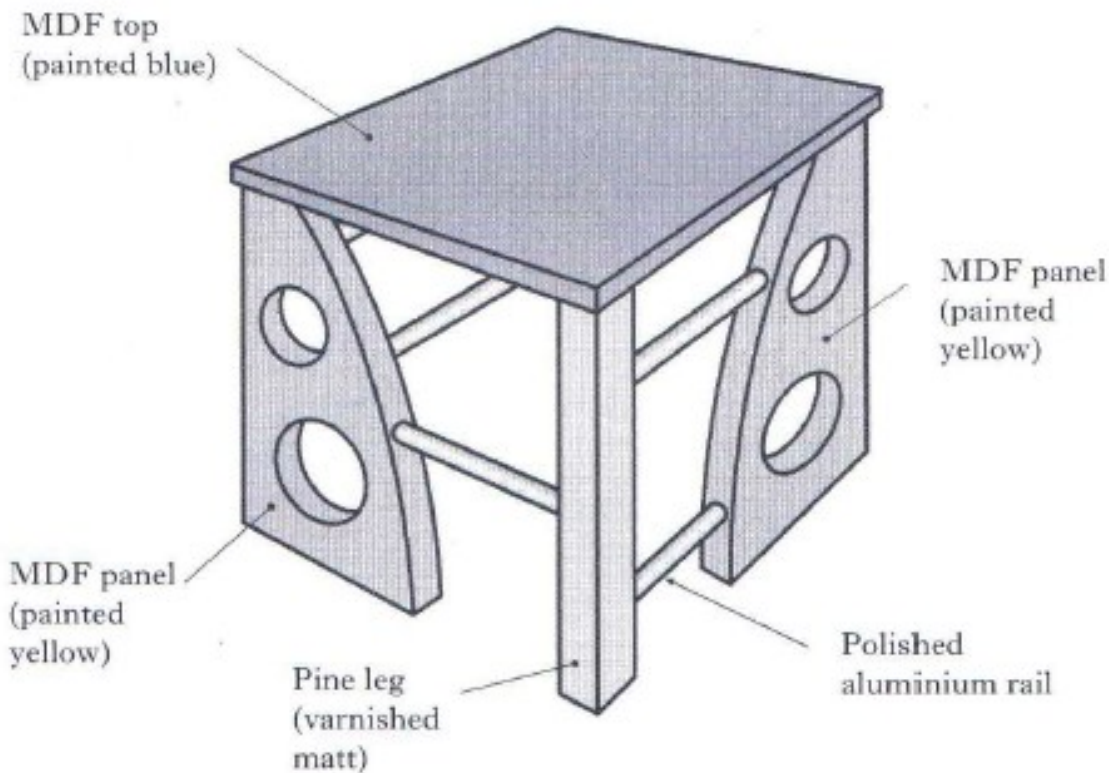
Using each design factor once, complete the diagram below.



5 marks

12

A pupil's design for a table is shown below.



(a) The pupil used the theme of "architecture" to help generate ideas.

State another method used to generate ideas.

(b) The target market was investigated during the design of the table.

State what is meant by the "target market".

(c) Aesthetics was considered during the design of the table.

Contrast is one aspect of aesthetics.

(i) State **two** examples of contrast used in the design of the table.

1 _____

2 _____

4 marks

13

An evaluation of the sports activity helmet shown below is to be carried out by the manufacturer.



Describe how the following methods could be used to evaluate aspects of the helmet:

(Note: a different aspect must be used for each method)

- | | | | |
|-----|--|-------------|---|
| (a) | (i) | user trial; | 2 |
| | (ii) | test rig; | 2 |
| | (iii) | survey. | 2 |
| (b) | The symbol shown below can be found on the helmet. | | |



- | | | | |
|-----|------|--|-------------|
| | | State the name of this symbol and explain its purpose. | 2 |
| (c) | (i) | Helmets are often made from <i>composite materials</i> .
Explain the term <i>composite material</i> . | 1 |
| | (ii) | State the name of any composite material. | 1 |
| | | | (10) |

14

The ability to generate ideas is an important aspect of a designer's work.

(a) State **two** idea generation techniques.

2

(b) Describe **one** of these techniques.

3

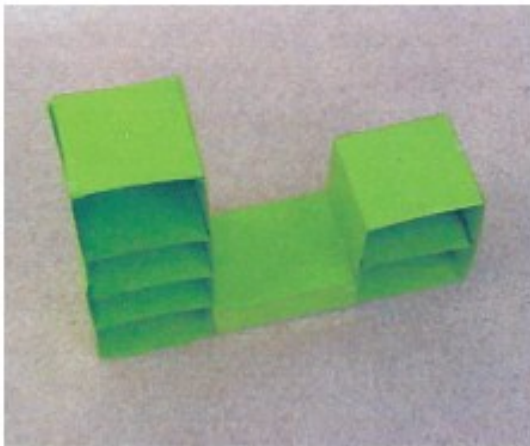
(5)



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15

Designers make use of modelling at various stages of the design process. Four types of model are shown below.



A Sketch model made from card



B Block model made from styrofoam



C Rapid prototype



D CAD model

For each type of model shown, state:

(a) the stage in the design process when it would be used; and

4

(b) the **advantages** to be gained by modelling at that stage.

4

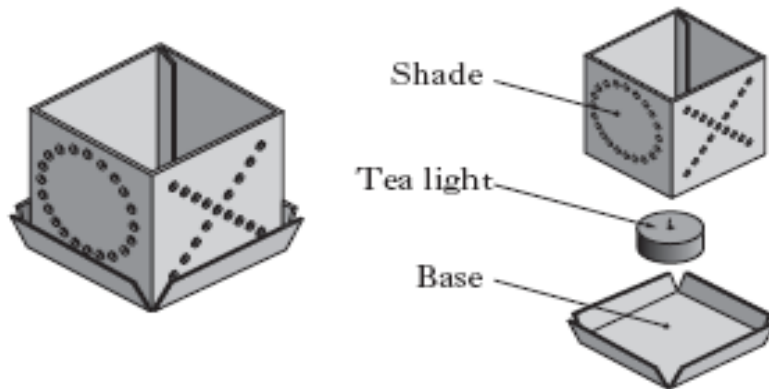
(8)

metal questions



1

A tea light holder made from sheet aluminium is shown below.



(a) Manufacturing and aesthetics were considered during the design of the tea light holder.

(i) State a manufacturing reason for using aluminium.

(ii) State an aesthetic reason for using aluminium.

(b) A circle was scribed during the marking out of the aluminium shade.

(i) State the name of the metal working tool used.

(ii) A line was drawn parallel to an edge during the marking out of the aluminium base.

State the name of the metal working tool used.

(c) Holes were drilled in the aluminium shade.

(i) State the name of a suitable drill bit.

(ii) The drill slipped on the aluminium.

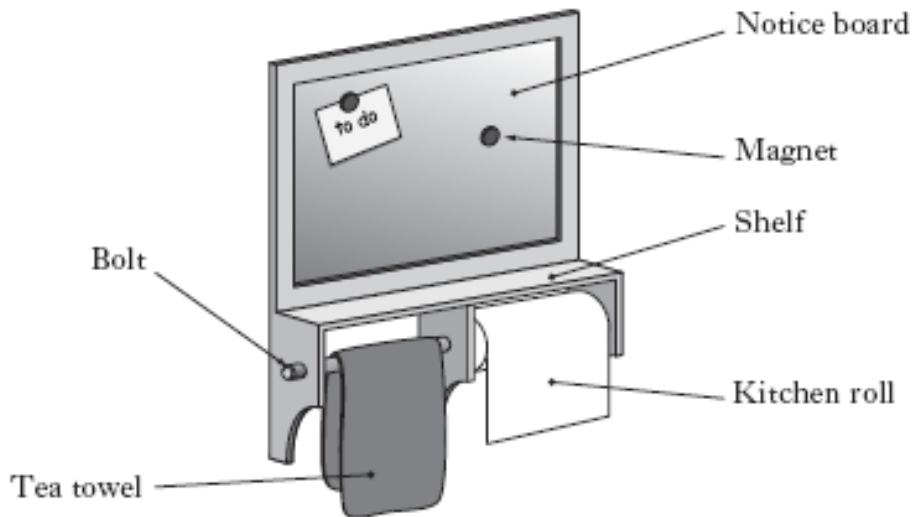
State a method of preventing the drill from slipping.

(iii) During drilling a ragged edge formed on the under edge of the aluminium.

State how this edge could be removed.

2

A kitchen unit is shown below.



(a) The notice board is magnetic.

(i) State the name of a metal that could be used for the notice board.

(ii) The shelf was made from a hardwood.

State the name of a suitable hardwood.

(b) The aluminium parts shown below were manufactured using a metalwork lathe.



(i) A change of speed can be required when using a metalwork lathe.

State **three** general reasons why a change in speed may be necessary.

1 _____

2 _____

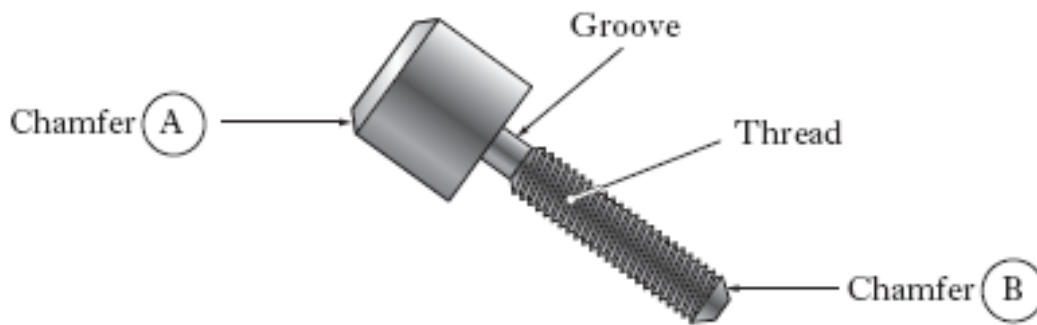
3 _____

(ii) The turning tool was slightly below centre when facing the bolt.

State what effect this would have.

3

A bolt is shown below.



The ends of the bolt were chamfered.

(iii) State the reason for:

Chamfer (A) _____

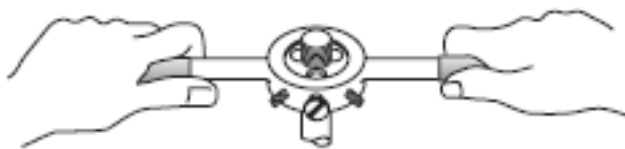
Chamfer (B) _____

(iv) State the name of the slide that is adjusted to 45° to enable the chamfer to be cut.

(v) A groove was cut in the bolt.

State the name of the turning tool used to cut the groove.

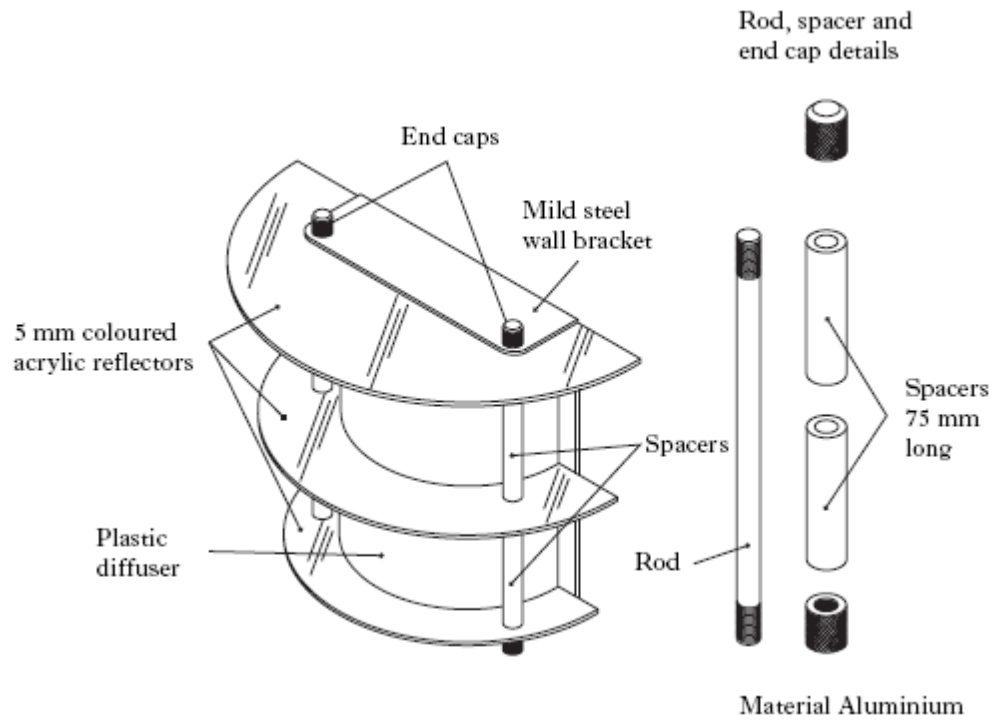
One end of each bolt was threaded.



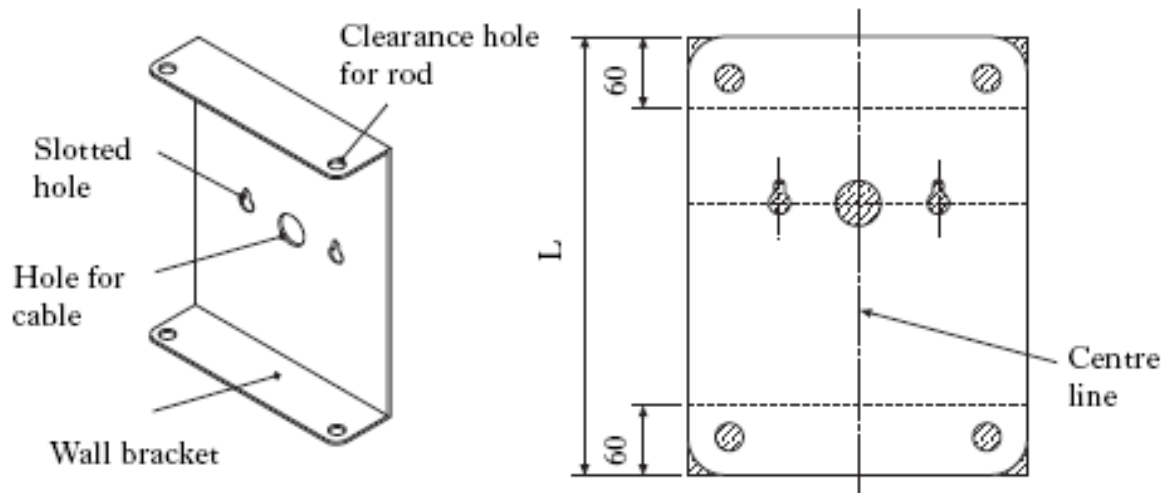
(c) State the diameter of metal required for an M6 thread to be cut.

(d) The bolt was difficult to tighten.

State a modification to the bolt head to improve finger grip.



(d) The mild steel for the wall bracket was marked out as shown.



(i) Mild steel is a ferrous metal.

State what is meant by a ferrous metal.

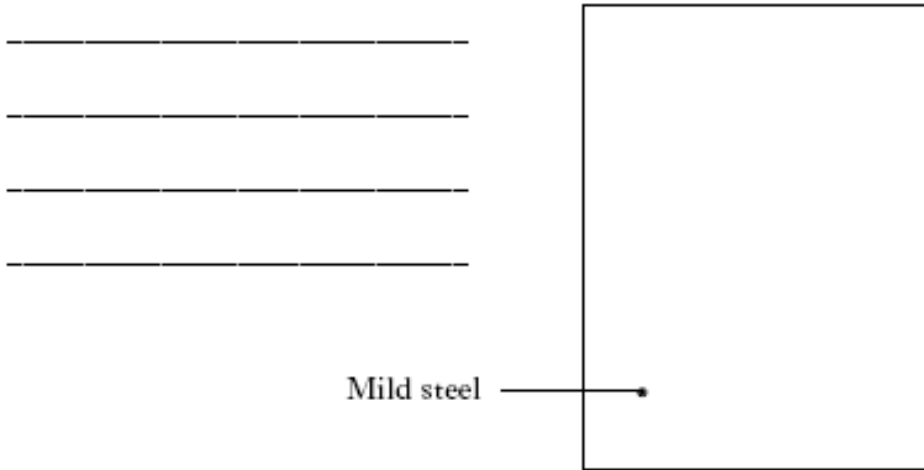
(ii) The wall bracket holds three acrylic reflectors and two spacers.

State the total length (L) of the material required for the wall bracket.

Total length (L) _____

(continued)

- (iii) A centre line was marked on the material for the wall bracket. Describe how odd leg callipers can be used to scribe a centre line without the use of a ruler. *Sketches may be used to illustrate your answer.*



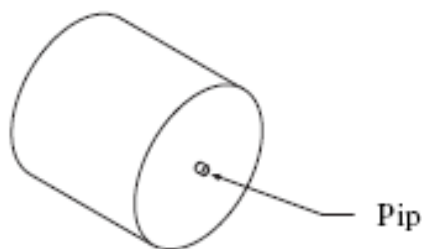
- (i) The mild steel was drilled.

State a reason why the metal was centre punched before drilling.

- (ii) State a reason for the slotted holes in the wall bracket.

- (i) The end caps were faced off using a metal lathe.

State **one** fault that would result in a small “pip” forming on the cap during turning.



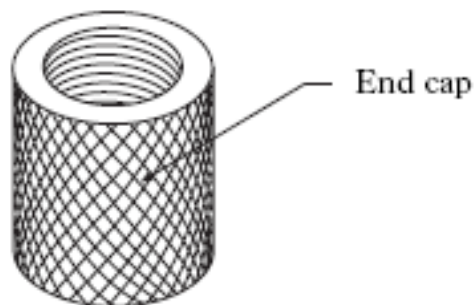
- (ii) During the manufacture of the end caps the tool shown below was used.



State the name of this tool.

State the purpose of this tool.

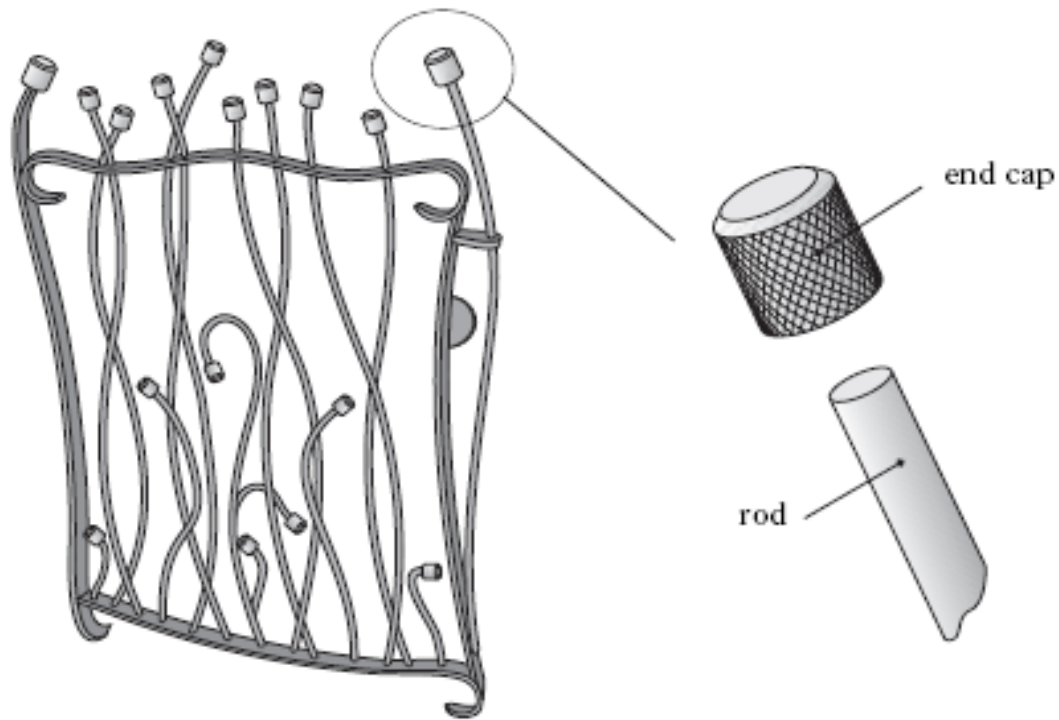
- (iii) A metal lathe was used when drilling a blind hole in each end cap.



Describe a method of ensuring the depth of the blind holes is 30 mm.

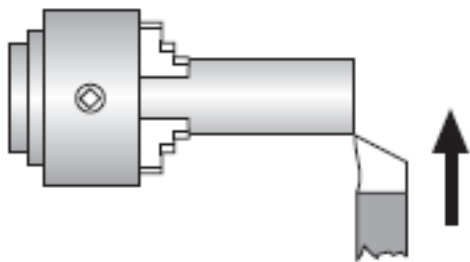
5

A metal gate is shown below.

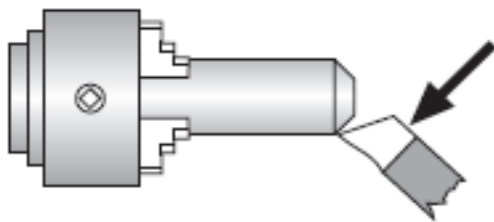


(a) The end caps were manufactured using a metal lathe.

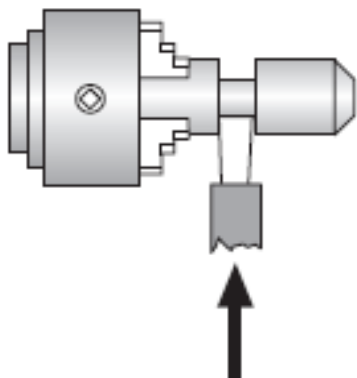
(i) State the names of the turning processes shown below.



Process A _____



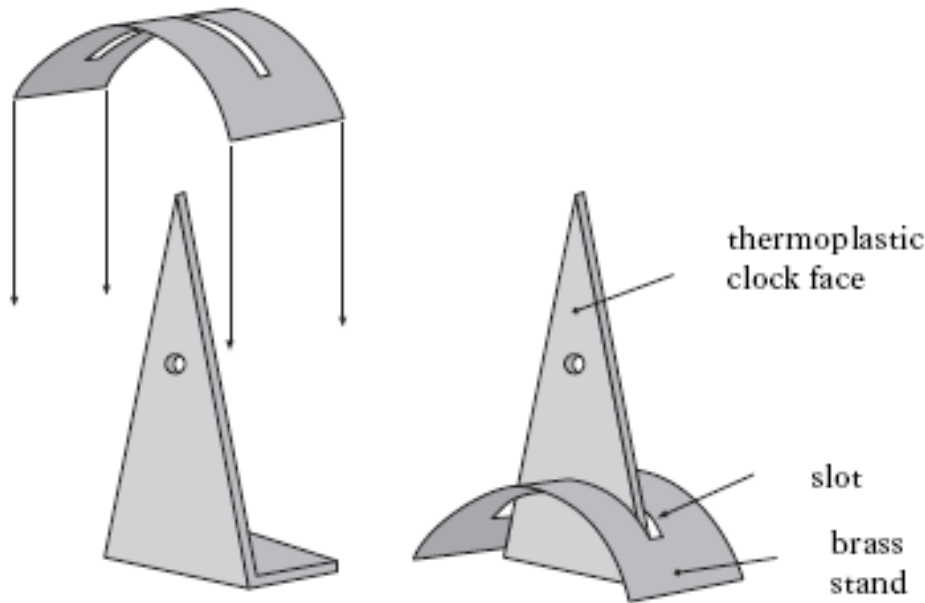
Process B _____



Process C _____

6

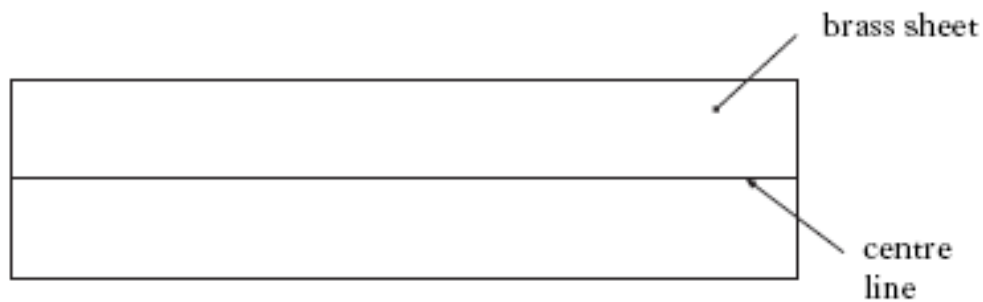
A clock is shown below.



- (a) The stand is made from brass sheet. Brass is an alloy.

State the meaning of the term "alloy".

- (b) Odd-leg callipers were used to mark the centre line of the slot on the brass sheet as shown below.



Describe a method of setting the odd-leg callipers to half the width of the brass sheet without the use of a rule. Sketches may be used to illustrate your answer.

7

A traditional watering can is shown below.



The watering can is made from galvanised mild steel and brass.

- (a) (i) State a functional reason for galvanising the mild steel. 1
(ii) State **two** suitable methods of joining the handles to the body of the watering can. 2

Modern styles of watering can are usually manufactured from thermoplastics.

- (b) State **three** advantages for the consumer of using thermoplastics for this type of product. 3
(6)

8

A claw hammer is shown below.

Head: Forged alloy steel

Shaft: GRP (Glass Reinforced Plastic)



- (a) State **two** reasons why the designer has chosen forged alloy steel for the head of the claw hammer. 2
(b) State **two** reasons why the designer has chosen GRP for the shaft of the claw hammer. 2
(c) Describe the appeal of the claw hammer to the consumer. 2
(6)

9

A three pin electrical plug is shown below.



- (a) (i) The alloy used to make the pins of the plug is brass.
State the name of **two** other metal alloys. 2
- (ii) The symbol shown below can be found on the electrical plug.



State the purpose of this symbol. 1

- (b) Portable electric tools can use either battery or mains power.
- (i) Explain the advantages of using battery power. 2
- (ii) Explain the advantages of using mains power. 2
- (7)**

Plastic questions



1

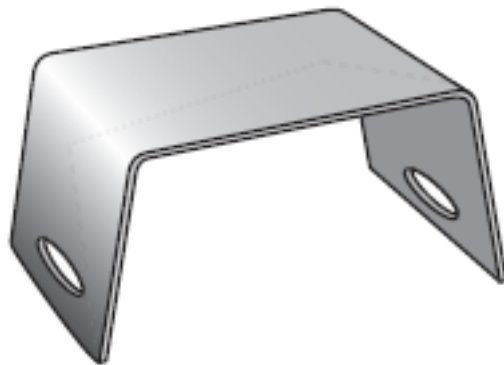
Environmental issues were considered during the design of the laptop table.

(e) State **two** environmental issues that could have been considered.

1 _____

2 _____

Acrylic was removed to form the handles.



(f) State how the waste material could be removed.

. A radio controlled racing car is shown below.

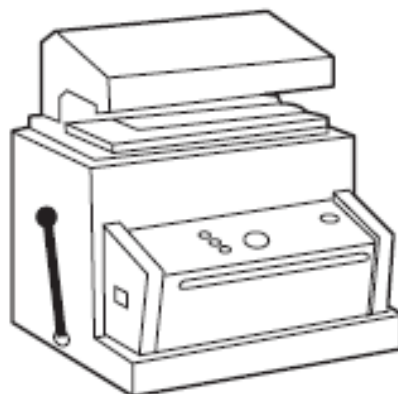
2



- (a) (i) The body shell was made from polystyrene, a type of thermoplastic.
State what is meant by the term *thermoplastic*.

- (ii) Acrylic was rejected as a possible material for the body shell.
State a reason why acrylic was considered an unsuitable material.

- (b) (i) The body shell was manufactured using the machine shown below.
State the name of this machine.



Name _____

2 contd

(ii) Some stages in the manufacture of the body shell are listed below in the wrong order.

- when cool, unclamp the plastic and remove the pattern
- heat the plastic until soft
- switch on the pump and suck out the air
- remove the heat and raise the pattern into the soft plastic

Using the stages listed above, complete the following sequence of operations.

Sequence of operations

1 Place the pattern in the machine and clamp the plastic

2 _____

3 _____

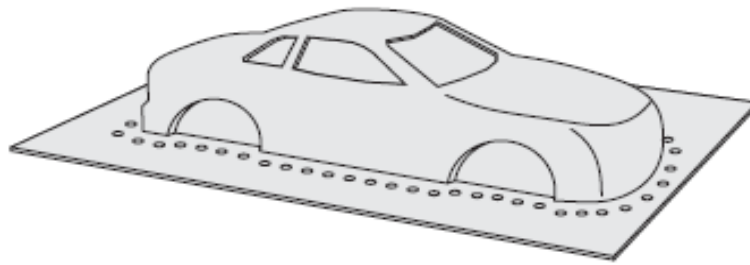
4 _____

5 _____

6 Trim off excess plastic

The pattern used during the manufacture of the body shell is shown below.

3



Sloping sides, rounded corners and small holes are all features of the pattern.

State a reason for each feature.

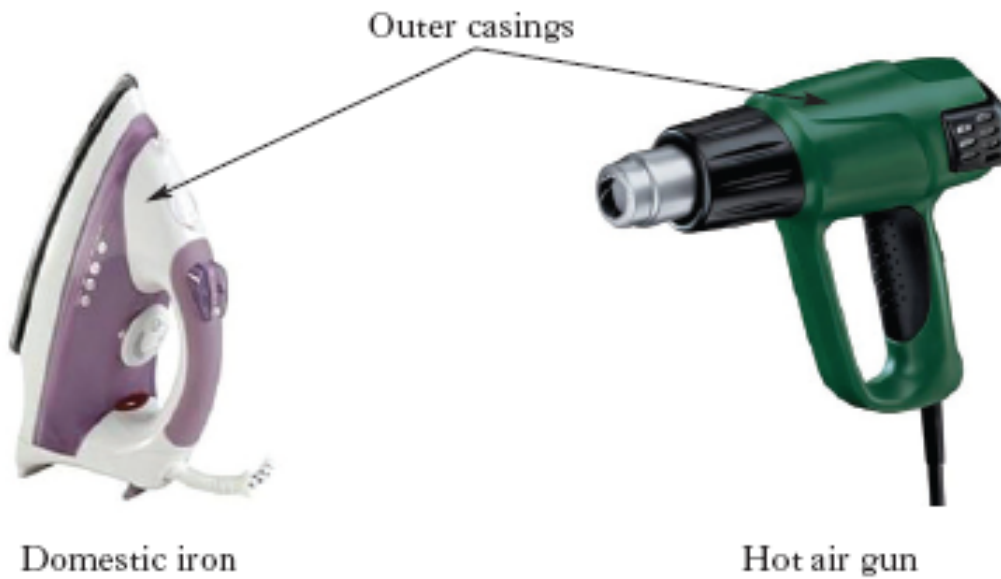
(i) Sloping sides

(ii) Rounded corners

(iii) Small holes

The outer casings of the two products shown below have been injection moulded.

4



- (a) (i) State **three** features which would confirm that injection moulding is the manufacturing process used for the outer casings. 3
- (ii) State **two** advantages to the manufacturer of using injection moulding to produce the outer casings. 2
- (b) State how the designer could find out the correct sizes for the handles of the two products **without** referring to anthropometric data tables. 1

Both products were designed with *planned obsolescence*.

- (c) (i) State an advantage of planned obsolescence to the manufacturer. 1
- (ii) State **two** reasons why planned obsolescence is harmful to the environment. 2
- (9)

Designers try to ensure that their products are “environmentally friendly”.

5

(a) With reference to the design of products, explain each of the following environmental terms:

(i) sustainable forests;

2

(ii) planned obsolescence.

2

(b) The symbol shown below is often found on plastic products which have been mass-produced.



State **two** pieces of information communicated by this symbol.

2

(6)

The drawer of the jewellery unit is also changing to contain a thermoplastic facing. The photos below show the piece of plastic cut to size and the rough edge of the plastic after sawing.

6



Describe **four** stages required to create a smooth surface finish on the sawn edges of the piece of plastic.

A selection of plastic trays from the inside of chocolate boxes is shown below.

7



(a) The plastic trays have been manufactured by vacuum forming.

Explain **why** the following features are found on vacuum formed products:

- (i) thinning;
- (ii) rounded internal corners;
- (iii) tapered surfaces.

3

(Sketches may be used to illustrate your answers.)

(b) The plastic trays are made from a thermoplastic.

Describe the main differences between thermoplastics and thermosetting plastics.

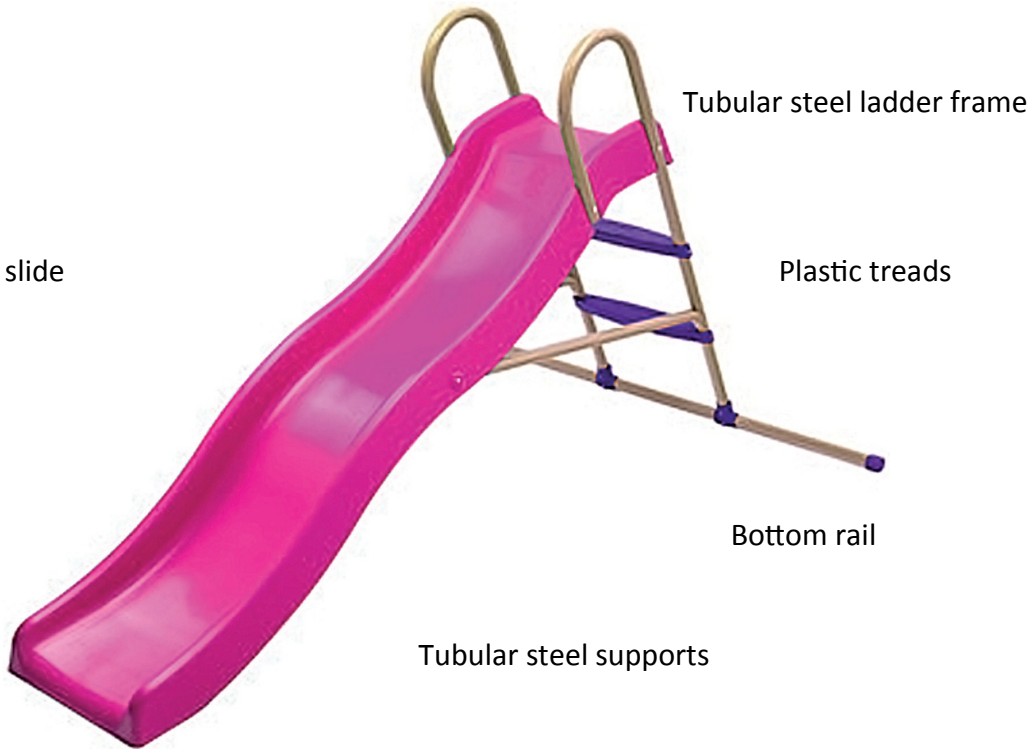
2

(5)

A child's play chute is shown below

8

Plastic slide



(a) (i) State the name of a suitable material for the chute of the slide.

1

(ii) Give **two** reasons why the material you have stated would be suitable for use in this type of product.

2

(iii) State a suitable manufacturing process that could be used to manufacture the seat of the chair.

1

