Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

DESIGN AND TECHNOLOGY ORDINARY LEVEL 6187/1

PAPER 1 2 hours

Marks 100 **2022**

Additional Materials: A3 drawing paper for Question 14 only
Non-programmable calculator
Standard drawing equipment

INSTRUCTIONS AND INFORMATION TO CANDIDATES

- Write your Centre Number, Candidate Number and Name in the spaces at the top of this page and on all separate answer sheets used.
- Write in dark blue or black pen.
- You may use a soft pencil for any rough work, diagrams or graphs.
- Do not use correction fluid.
- Do not write in the margin *For Examiner's Use*.
- You may use blank pages for workings or when answers are crossed out and corrected.
- The number of marks is given in brackets [ ] at the end of each question or part question.
- You may use a non-programmable calculator.

Part A

- Answer **all** questions.
- Write your answers in the spaces provided on the Question Paper
- You should spend about 30 minutes on **Part A**

Part B

- Answer **one** question.
- **Question 14** should be answered on the separate A3 drawing paper.
- At the end of the examination staple your A3 work to this question paper.
- **Question 15 and 16** should be answered in the spaces provided on the question paper.

For Examiner's Use		
Part A		
Part B	**14**	.....
	15	.....
	16	.....
TOTAL		

Marker	
Checker	

This document consists of **34** printed pages and **2** blank pages.

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

For Examiner's Use

Part A

Answer **all** questions in the spaces provided.

1 Fig. 1 shows a soldering iron.

Fig. 1

(a) Name **two** types of safety equipment that must be used when soldering.

1 .....

2 ..... [2]

(b) Select the material from the list below that can be joined by soldering.

acrylic, brass, teak, hardboard

..... [1]

(c) State what is meant by each safety symbol shown below.

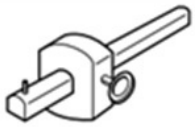
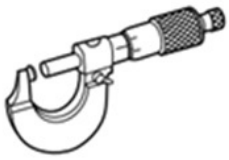
..... [1]

..... [1]

For Examiner's Use

2 Complete Table 1 by naming each tool.

Table 1

Tool	Name
	.....
	.....
	.....

[3]

3 Fig. 2 shows a remote control

Fig. 2

Suggest **three** ergonomic features of the design of the remote control.

1.....

.....

2.....

.....

3.....

..... [3]

4 Fig. 3 shows a symbol found on a product made from a plastic.

Fig. 3

State what is meant by the arrowed lines around the number 2.

.....

..... [1]

5 Fig. 4 shows a rugby ball and holder.

Fig. 4

(a) Evaluate the rugby ball holder in terms of stability.

.....

.....

.....

..... [2]

(b) Use sketches and notes to show a method of making the rugby ball holder from a thermoplastic.

[3]

6 Fig. 5 shows the end of a piece of wood. Two holes will be drilled at the centres shown.

Add to Fig. 5 to show a drilling jig that could be used to make sure that the holes are drilled accurately.

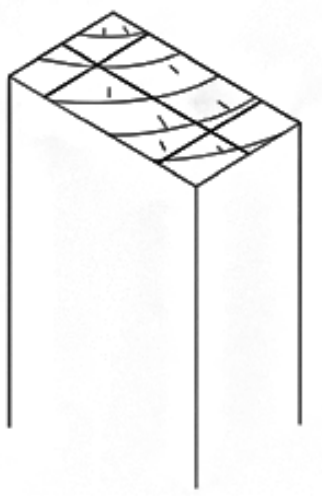


Fig. 5

[4]

7 Fig. 6 shows a toy car and a machine part. Both are made by the die casting process.

Fig. 6

Give **two** benefits of using the die casting process to make products.

1.....

.....

2.....

..... [2]

8 Fig. 7 shows a chair made from wood.

Fig. 7

(a) Name the process by which the curved parts of the chair are shaped.

..... [1]

(b) Give **one** benefit of using this type of process when making the chair.

..... [1]

For Examiner's Use

9 Fig. 8 shows a car shell made from carbon fibre reinforced plastic (CFRP).

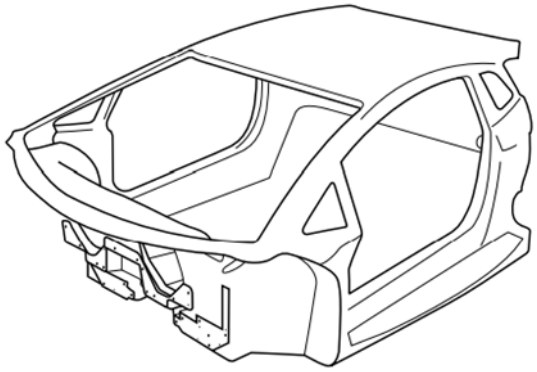


Fig. 8

(a) Give **two** advantages of using carbon fibre reinforced plastic (CFRP) rather than steel for the car shell.

1 .....

.....

2 .....

..... [2]

(b) Give **two** reasons why aluminium would be used to make the car shell.

1 .....

.....

2 .....

..... [2]

For Examiner's Use

10 Fig. 9 shows a container used in a fast food outlet.

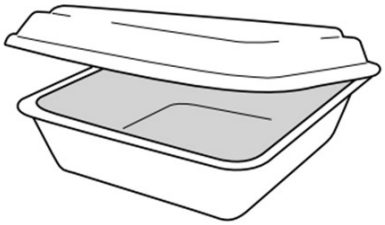


Fig. 9

(a) Name a suitable plastic that could be used to make the container.

..... [1]

(b) (i) Give **one** advantage of using a plastic for this type of container.

.....

..... [1]

(ii) Give **one** disadvantage of using a plastic for this type of container.

.....

..... [1]

11 Complete Fig. 10 to show a through housing joint.

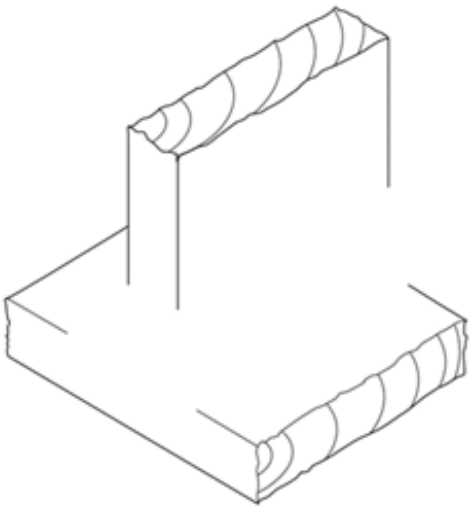


Fig. 10

[3]

12 Fig. 11 shows two simple circuit diagrams, **A** and **B**, for lighting a light emitting diode (LED).

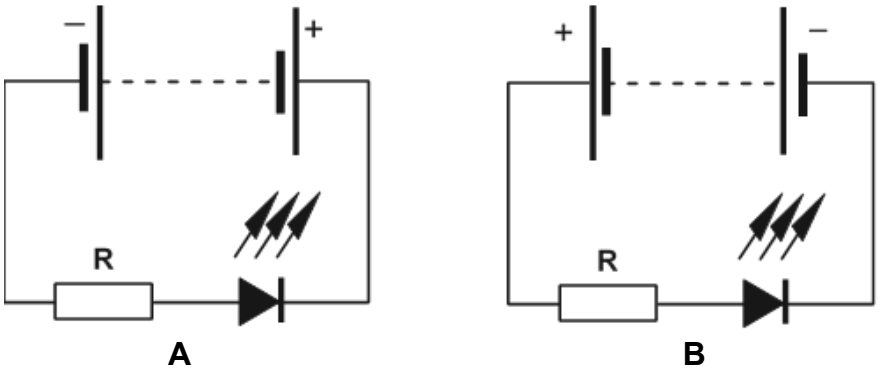


Fig. 11

The power supply to one of the circuits in Fig. 11 has been connected incorrectly.

(i) State which one of the circuits, **A** or **B**, has been connected incorrectly.

..... [1]

13 Fig. 12 shows a dog house.

Fig. 12

Write **four** specification points for the dog house shown in Fig. 12

1.....

.....

2.....

.....

3.....

.....

4.....

..... [4]

[40]

For Examiner's Use

Part B

Answer **one** question from Part B.

14 Design Communication

Answer the whole of this question on separate A3 drawing paper

Fig. 13 shows a isometric drawing of a wooden frame for a fire screen.
Material dimensions: 50 mm × 20 mm.

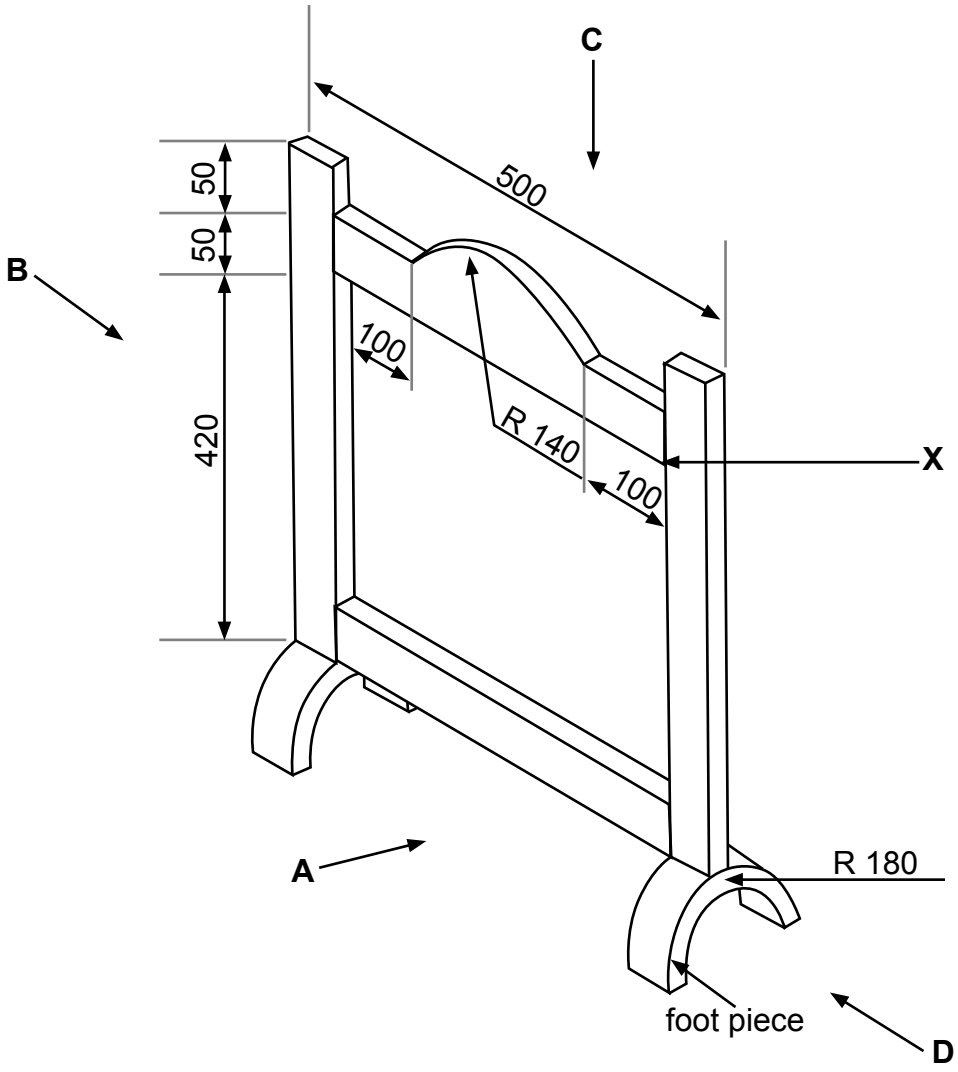


Fig. 13

(a) To a scale 1:2, and showing all hidden detail, draw:

(i) a front elevation of the wooden frame as seen from the direction of arrow **A**, [12]

(ii) an end elevation as seen from the direction of arrow **B**, [10]

(iii) a top view as seen from the direction of arrow **C**. [8]

(b) Add **four** dimensions, that conform to the SANS code, to the drawing produced in **(a)**. [5]

For Examiner's Use

(c) The semi-circular foot pieces of the fire screen are produced from plywood (5 ply). Produce a sketch of **one** foot piece, as seen from the direction of arrow **D**, and render it to look like plywood. [7]

(d) Draw an exploded freehand sketch of a joint that could be used to join corner **X**. Add rendering to the sketch. [8]

(e) Use sketches and notes to show a design for a logo for the company, FURN FOR NAM, which manufactures the fire screens. [10]

[60]

For Examiner's Use

15 Resistant Materials

Answer Question 15 in the spaces provided on the question paper.

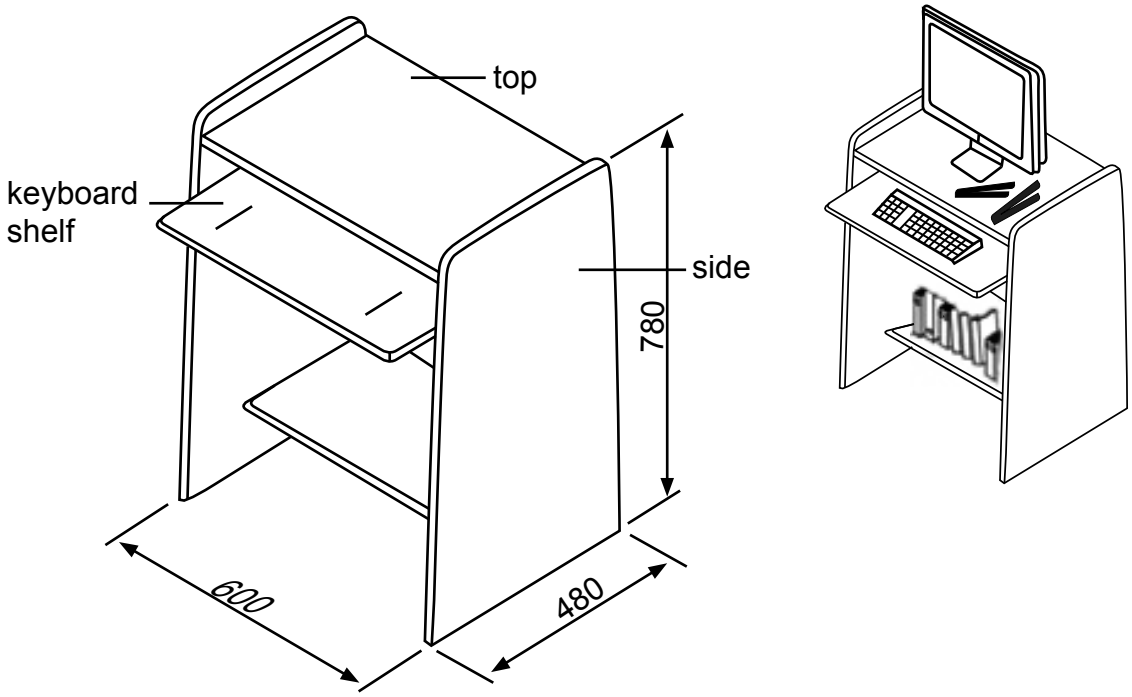


Fig. 14

(a) Give **two** benefits of flat-pack furniture for:

(i) the consumer

1 .....

.....

2 .....

..... [2]

(ii) the manufacturer.

1 .....

.....

2 .....

..... [2]

For Examiner's Use

(b) Use sketches and notes to show how knock-down (KD) corner blocks could be used to join the top to one side of the computer desk.

[4]

(c) Use sketches and notes to show how the keyboard shelf in Fig. 14 could be made to move in and out.
Include details of materials and constructions used.

[4]

(d) Fig. 15 shows a desk tidy made from plastic.

Fig. 15

(i) Give **three** specification points for the desk tidy.

1 .....

2 .....

3 ..... [3]

(ii) Complete the statement by adding the correct material from the list below.

thermosetting plastic, manufactured board carbon steel, composite material

Hardening and tempering is a process that is carried out on .....

..... [1]

(e) Fig. 16 shows details of a table football game.

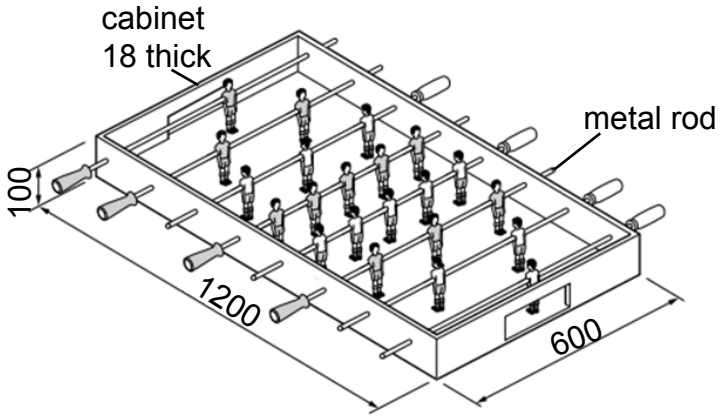


Fig. 16

(i) The metal rods could be made from Ø10 mild steel or aluminium. Choose either mild steel or aluminium and give a reason for your choice.

Chosen metal ..... [1]

Reason..... [1]

For Examiner's Use

(f) When pulled and pushed, the rods cause the holes in the side of the cabinet to become worn and enlarged.

Use sketches and notes to show how this problem could be overcome. Name any materials used.

[3]

(g) Fig. 17 shows a metal rod that will be attached to a wooden handle by means of an epoxy resin adhesive.

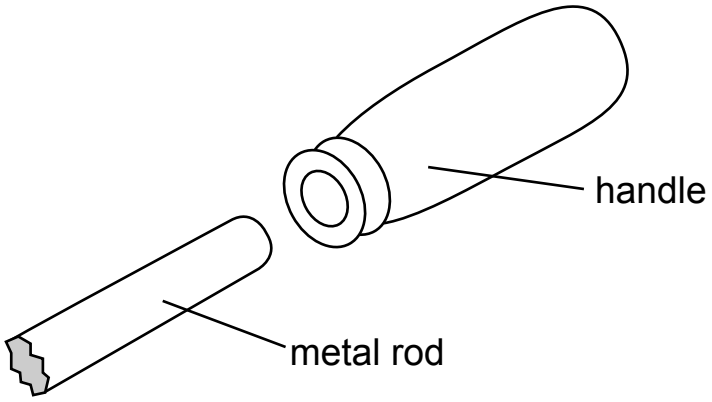


Fig. 17

(i) Describe how an epoxy resin adhesive would be prepared and applied.

.....

.....

.....

..... [2]

(ii) Describe how polymorph could be used to determine the shape of the handle.

.....

.....

.....

..... [2]

For Examiner's Use

(h) (i) Fig. 18 shows one of the table football game players and the metal rod to which it is attached. The players are made from injection moulded plastic. Add sketches and notes to Fig. 18 to show how the player could be fixed to the metal rod without the use of adhesive.

Fig. 18

[3]

For Examiner's Use

(ii) Fig. 19 shows a cross-sectional view of an injection moulding machine. Complete table 2 below to give the stages in the injection moulding process.

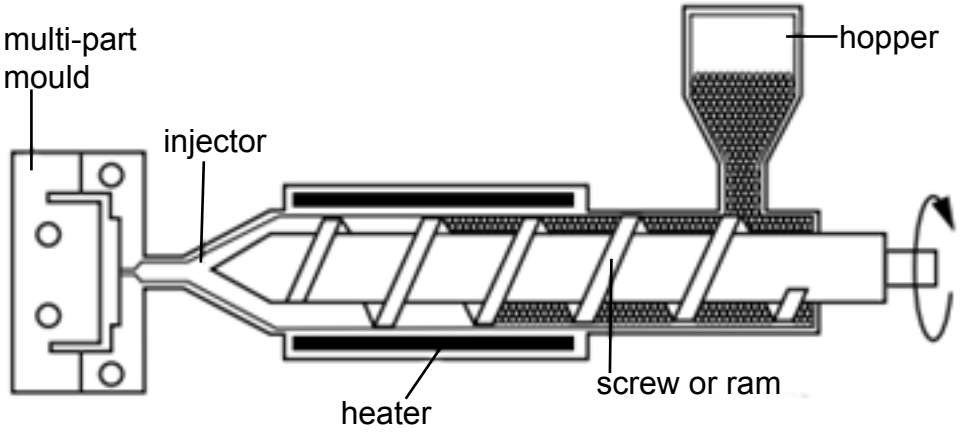


Fig. 19

Table 2

Stages	Process
1	
2	
3	
4	
5	The mould is cooled and the moulding ejected

[4]

(iii) Explain why the injection moulding process is only suitable when manufacturing in large quantities.

.....

.....

.....

..... [2]

(iv) Name a process that could be carried out in a school workshop to produce the players using aluminium.

.....

..... [1]

For Examiner's Use

(v) Use sketches and notes to design a scoring system that could be used during a game of table football.

The scoring system must:

- be fixed to the cabinet
- record a maximum of five goals scored at each end.
  Include details of materials and fittings used.

[6]

(i) Fig. 20 shows a hardwood shelf supported by two end brackets.
The brackets could be made from acrylic or aluminium.

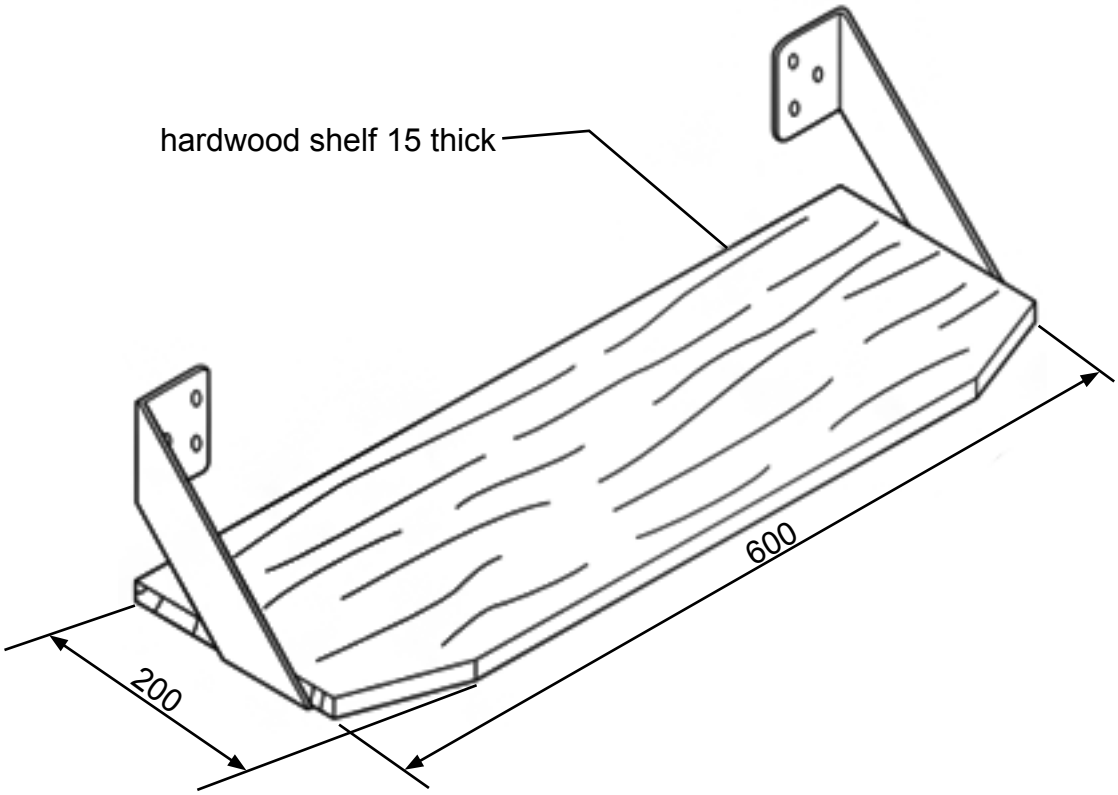


Fig. 20

(i) Give **two** benefits of using a template to mark out the shape of a bracket.

1 .....

2 ..... [2]

(ii) Explain why a template would need to be made from wood or metal rather than card or paper when marking out large quantities of brackets.

.....

.....

.....

..... [2]

(iii) Acrylic and aluminium are materials that can be self-finished.
Explain what is meant by the term '*self-finished*'.

.....

.....

.....

..... [2]

For Examiner's Use

(j) (i) Fig. 21 shows the shape of one bracket marked out on sheet material.

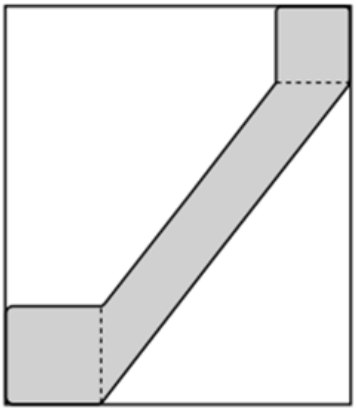


Fig. 21

You may choose to make the bracket in either 4 thick acrylic or 1.5 thick aluminium. Use sketches and notes to show how one bracket could be cut out by hand and the edges made smooth on the material of your choice. Name all the tools and equipment used.

Chosen material .....

[5]

For Examiner's Use

Use sketches and notes to show how one of the bends could be produced when the bracket is made from:

(ii) 4 thick acrylic

[3]

(iii) 1.5 thick aluminium.

[3]

(k) Explain why round head screws rather than countersink head screws, would be used to screw the brackets to the wall when the brackets are made from 1.5 thick aluminium.

.....

.....

.....

..... [2]

[60]

For Examiner's Use

16 Technology

Fig. 22 shows the rear derailleur gear on a cycle with a close up view of the gear cable.

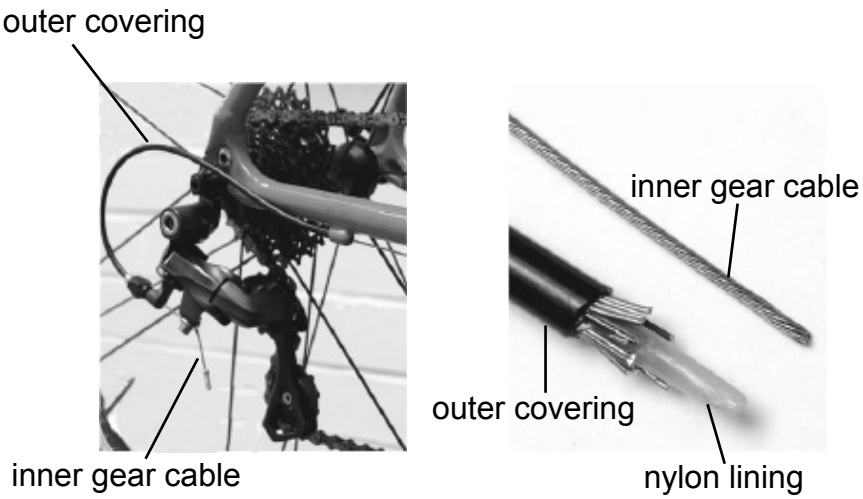


Fig. 22

(a) (i) Name the force that is applied, when manufacturing the inner gear cable to keep the strands of the cable in position

..... [1]

(ii) Give **two** benefits of using a nylon lining.

.....

.....

.....

..... [2]

(iii) Explain why small radius bends should be avoided in the gear cable.

.....

.....

.....

..... [2]

(iv) Explain why steel is used for control cables on a cycle.

.....

.....

.....

..... [2]

(v) State the force being used when a control cable is operated.

..... [1]

(b) Hydraulic systems are now used for many applications rather than a control cable.

(i) State the force created in a hydraulic system.

..... [1]

(ii) Fig. 23 shows the speed change lever on a wood turning lathe.

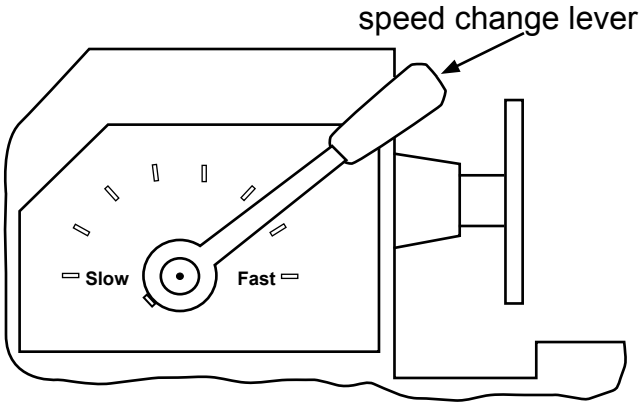


Fig. 23

(iii) On the speed change lever in Fig. 23 show the position of effort, load and fulcrum. [3]

(iv) State the order of lever used.

..... [1]

(c) **(i)** Complete Table 3 by selecting the correct terms for the list below.

bevel gear, idler gear, rack and pinion, worm gear.

Table 1

Requirement	Method
Transfer drive through 90° with no change in speed	
Provide a large reduction in speed in a small space	
Make driver and driven shafts rotate in the same direction	

[3]

For Examiner's Use

(ii) Fig. 24 shows a piece of rod with a square thread cut into it.

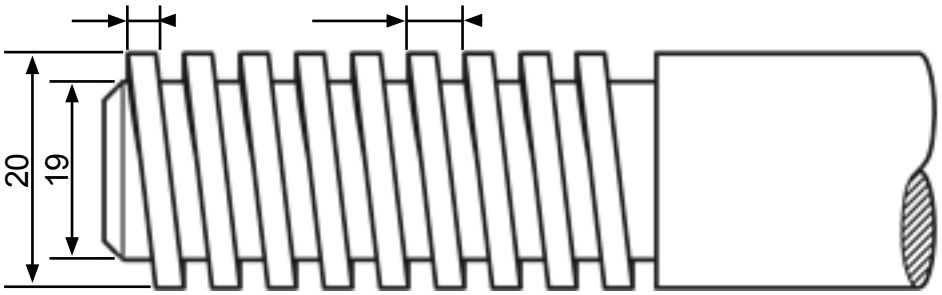


Fig. 24

State the pitch of the thread.

..... [1]

Fig. 25 shows two logic symbols.

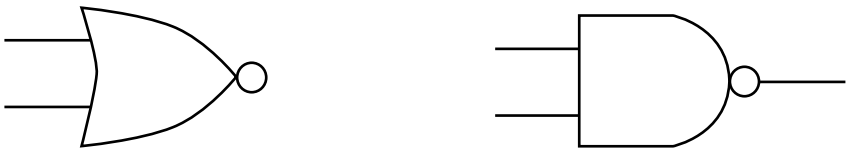
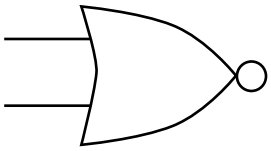


Fig. 25

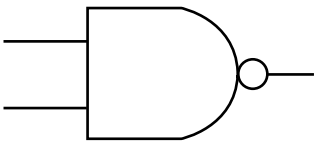
(iii) Name the two logic symbols in Fig. 25 and complete the truth table for each.



Name.....

A	B	Q1	Q2
0	0		
0	1		
1	0		
1	1		

[2]



Name.....

A	B	Q1	Q2
0	0		
0	1		
1	0		
1	1		

[2]

(d) A catalogue describes two capacitors in the following way:

- electrolytic capacitor 3300 µF 30 Vdc ± 20%

- ceramic capacitor 100 pF 50 Vdc ± 10%.

(i) Explain what is meant by 30 Vdc and 50 Vdc in the description of the capacitors.

.....

.....

.....

..... [2]

(ii) State why the electrolytic capacitor value is likely to vary more from its stated value than the ceramic capacitor.

.....

..... [1]

(iii) Name the discrete component used with a capacitor to produce a delay in a circuit.

..... [1]

(e) Fig. 26 shows the initial design for a scaffold to give safe access while building work is carried out.

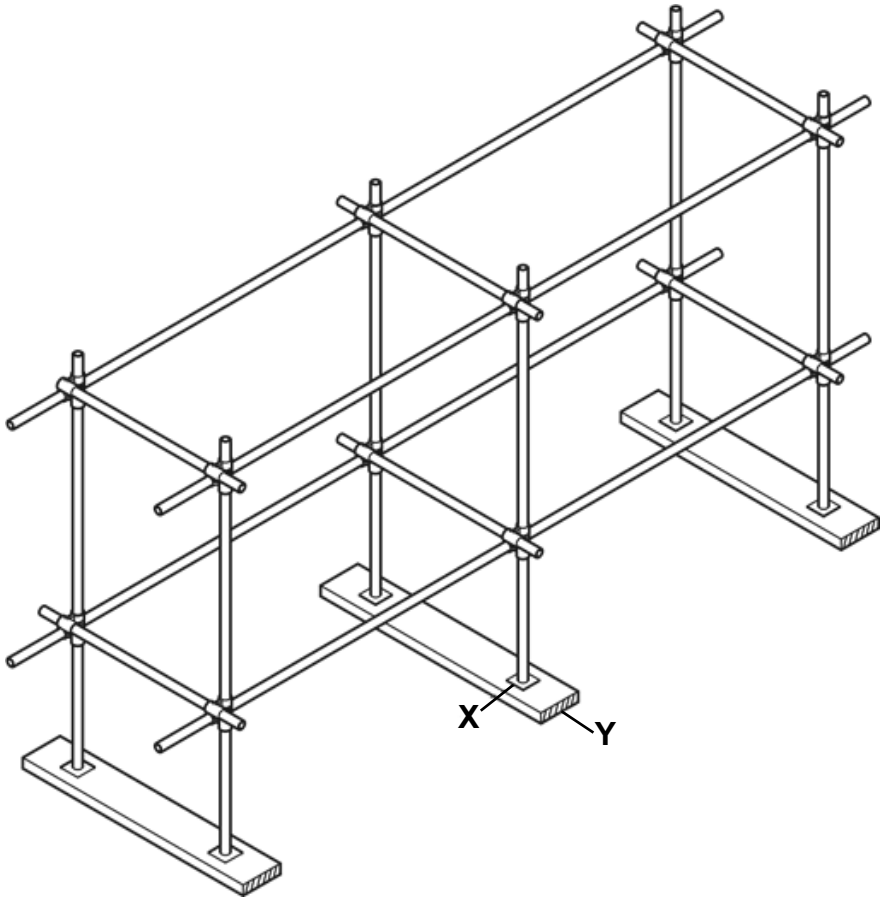


Fig. 26

(i) Name the type of structure used in scaffolding.

..... [1]

(ii) Draw on Fig. 26 three additional scaffolding poles to make the structure rigid and safe from collapse. [3]

(iii) Explain the purpose of features **X** and **Y** at the base of the scaffold.

.....

.....

.....

..... [2]

(f) The guide fence for the saw is held securely in place by a cam lever shown in Fig. 27.

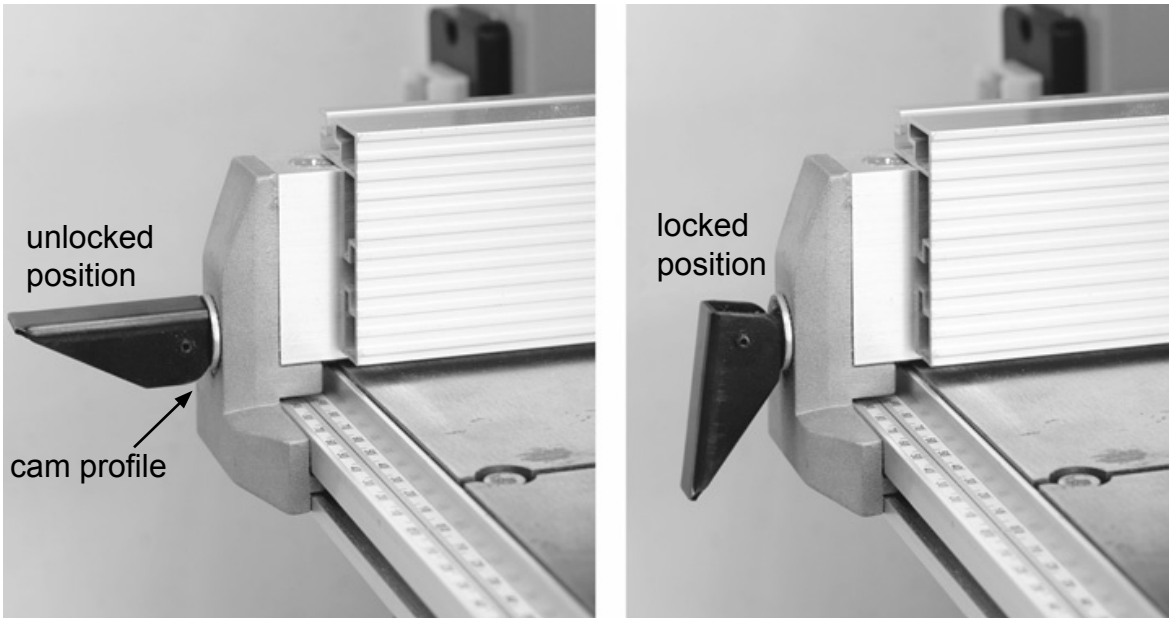


Fig. 27

Explain why cams are often used where frequent adjustment is necessary.

.....

.....

.....

..... [2]

(g) Fig. 28 shows a compound pulley system.

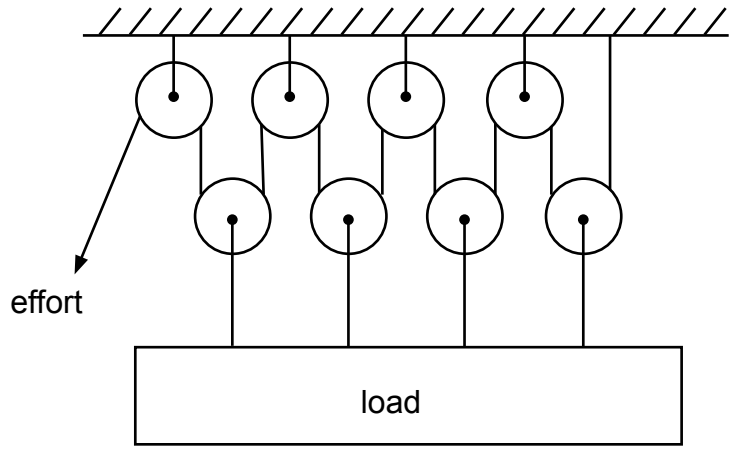


Fig. 28

(i) State the mechanical advantage of the pulley system.

..... [1]

(ii) Calculate the pulling force necessary to raise a load of 1.5 kN.

.....

.....

.....

..... [2]

(h) Fig. 29 shows a push switch that could be either a PTM switch or a PTB

switch, the two types are identical in size and colour.

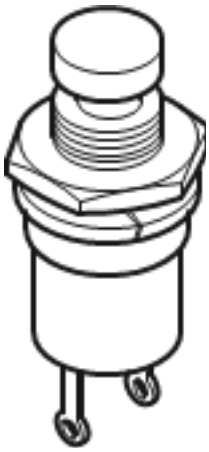


Fig. 29

Use sketches and notes to explain how the switch action can be identified using a multimeter on a resistance setting.

[3]

For Examiner's Use

(i) Fig. 30 shows three types of connecting wire that could be used to connect a switch to a circuit board.

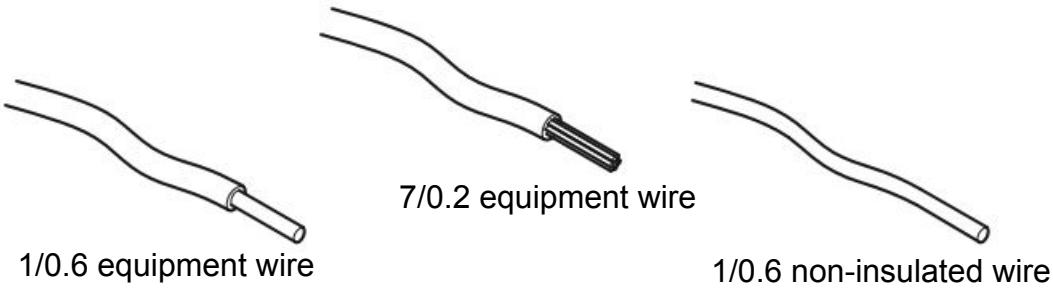


Fig. 30

(i) State which type of connecting wire is the most suitable.

..... [1]

(ii) Give **one** reason for your choice of connecting wire.

.....

..... [1]

(iii) Use sketches and notes to describe the stages in soldering a connecting wire to a switch terminal.

[4]

For Examiner's Use

(j) Fig. 31 shows a method of connecting a number of wires on a ribbon cable to a circuit board.

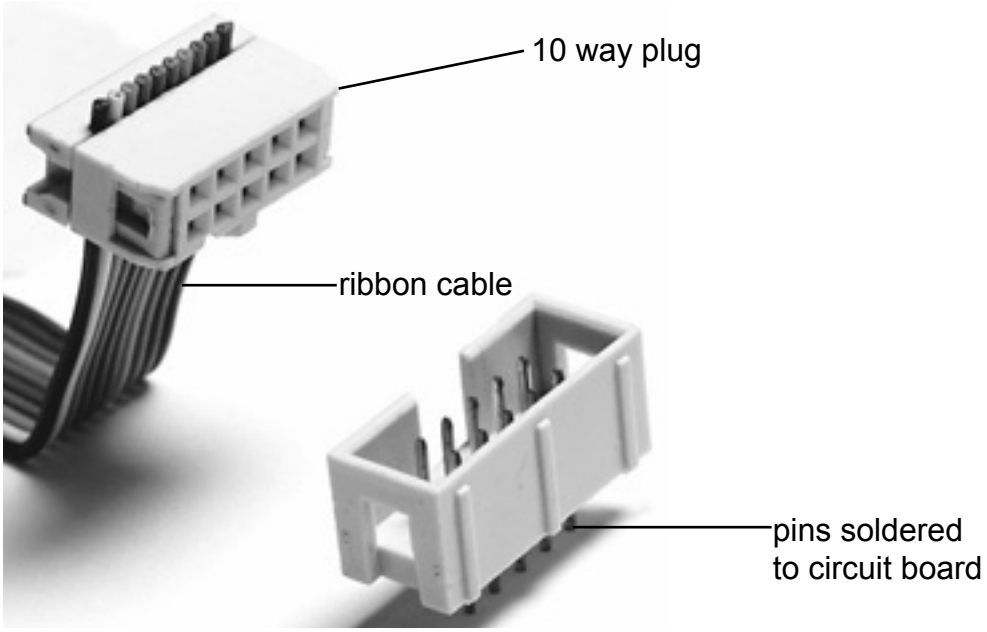


Fig. 31

Give **two** advantages of using this method rather than soldering individual wires to the circuit board.

1 .....

.....

2 .....

..... [2]

(k) Fig. 32 shows a conveyor belt in a supermarket checkout area. The belt keeps going until an item of shopping blocks the path between the light source and an LDR on the other side of the conveyor belt.

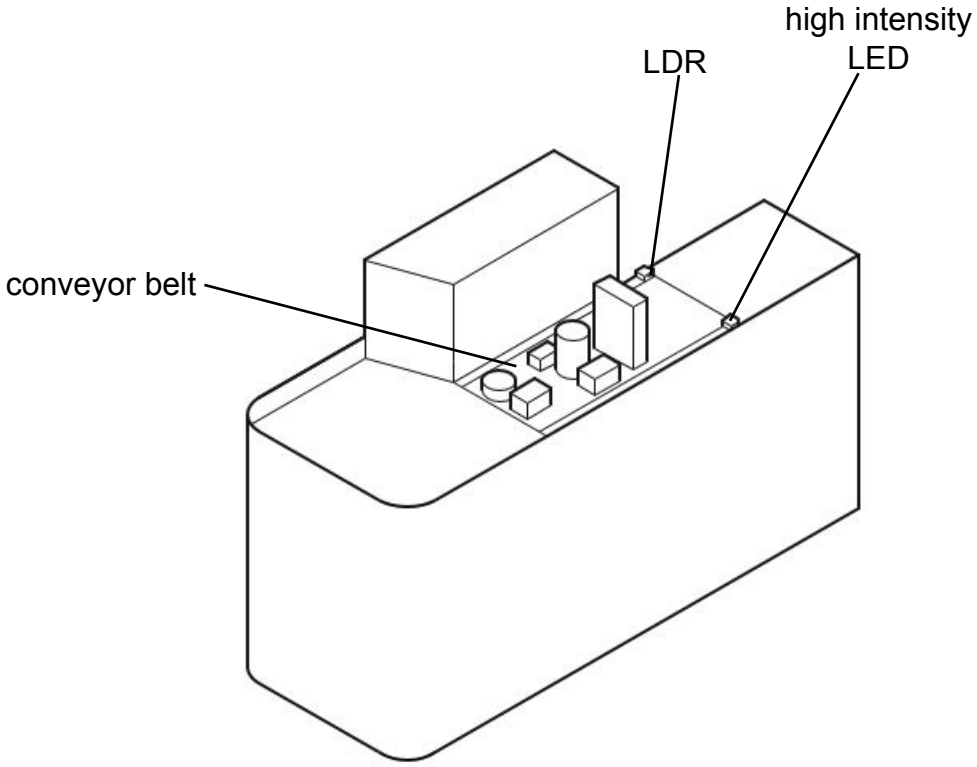


Fig. 32

Part of the operating circuit for the conveyor belt is shown in Fig. 33.

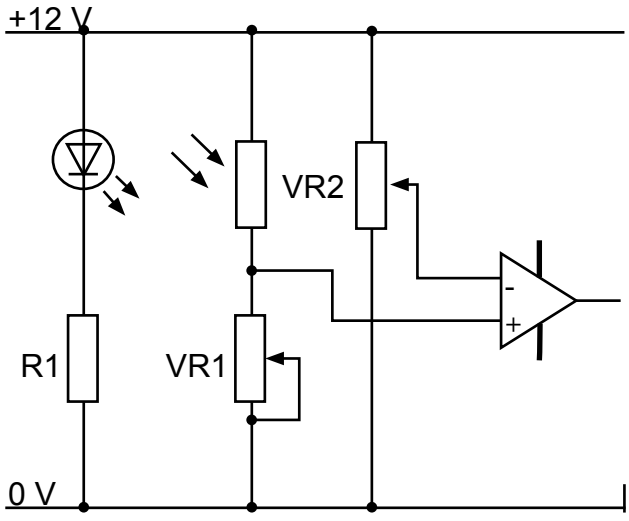


Fig. 33

For Examiner's Use

(i) Calculate the value of R1 that should be used to allow the high intensity LED to draw a current of 40 mA. The forward voltage of the LED is 3.4 V.

.....

.....

.....

..... [2]

(ii) The operating circuit uses a CA3140 operational amplifier to compare the voltage from the LDR potential divider with a reference voltage provided by VR2 potential divider. Explain what is meant by 'potential divider'.

.....

.....

.....

..... [2]

(iii) Explain the operation of a voltage comparator.

.....

.....

.....

.....

.....

..... [3]

(iv) State **two** ways of changing the sensitivity of the circuit.

1 .....

.....

2 .....

..... [2]

(v) The high output of the CA3140 operational amplifier is +10 V with a maximum current of 10 mA, which is not enough to operate the motor.

Complete Fig. 34 to show a transistor circuit that will operate the relay to switch the motor on and off.

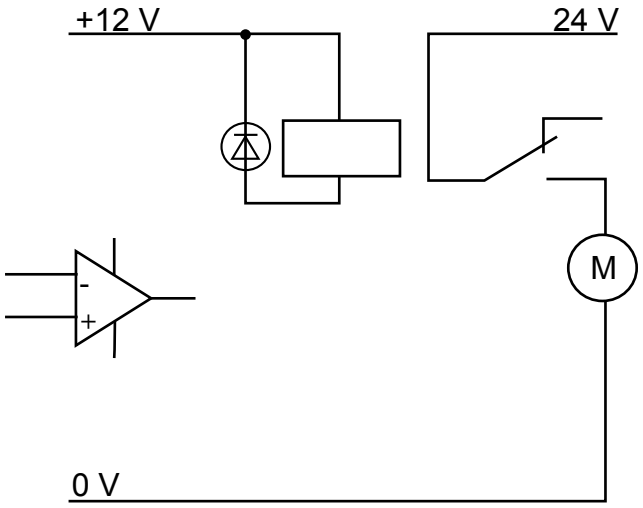


Fig. 34

[3]

(vi) Give **one** reason for using a relay to switch the motor on and off.

.....

..... [1]

[60]

For Examiner's Use

BLANK PAGE