A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
ENGINEERING
Unit 1 Written Paper

8852/W

Time allowed: 2 hours

For this paper you must have:
- **normal writing and drawing instruments**
- **a calculator.**

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

INSTRUCTIONS

- **Use black ink or black ball-point pen. Use pencil only for drawing.**

- **Answer ALL questions.**

- **You must answer the questions in the spaces provided. Do NOT write on blank pages.**

- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**

- **Some questions will require you to shade a circle. If you make a mistake cross through the incorrect answer.**

- **Do all rough work in this book. Cross through any work you do not want to be marked.**

INFORMATION

- **The marks for questions are shown in brackets.**

- **The maximum mark for this paper is 120.**

- **You are reminded of the need for good English and clear presentation in your answers.**
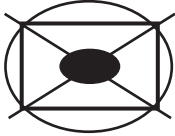
DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

For each question completely fill in the circle alongside the appropriate answer.

CORRECT METHOD

WRONG METHODS

If you want to change your answer you must cross out your original answer as shown.

If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown.

0 1 . 1

Which of the following describes an alloy? [1 mark]

○ **A   A liquid metal**

○ **B   A mixture including metallic materials**

○ **C   A mixture of non-metallic materials**

○ **D   A pure metal**

[Turn over]

0 5

0 1 . **2**

Which heat treatment process for steel involves heating to high temperatures then cooling rapidly in water?
[1 mark]

○ **A   Annealing**

○ **B   Galvanising**

○ **C   Hardening**

○ **D   Normalising**

0 1 . 3

Which of the following is a thermosetting polymer?
[1 mark]

○   **A   Acrylic**

○   **B   Nylon**

○   **C   Polypropylene**

○   **D   Polyurethane**

[Turn over]

0	1	.	4

Which of the following is a pushing force that moves an object forwards through the air? [1 mark]

○   **A**   **Drag**

○   **B**   **Friction**

○   **C**   **Lift**

○   **D**   **Thrust**

0 1 . 5

Which one of the following properties allows a material to resist bending? [1 mark]

○ **A   Brittleness**

○ **B   Hardness**

○ **C   Stiffness**

○ **D   Toughness**

[Turn over]

0 9

| 0 | 1 | . | 6 |

Which of the following is an output component?
[1 mark]

○ **A   Light dependent resistor**

○ **B   Light emitting diode**

○ **C   Thermistor**

○ **D   Timer**

| 0 | 1 | . | 7 |

Name the component shown in FIGURE 1. [1 mark]

FIGURE 1
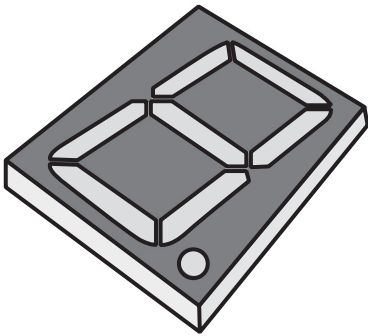
| ○ | **A**   **Capacitor**

| ○ | **B**   **Microcontroller**

| ○ | **C**   **7 Segment Display**

| ○ | **D**   **Transistor**

[Turn over]

0 1 . 8

Complete the following statements opposite using the word bank provided.

Composites are materials made by

_____ two or more

different materials.

They can have _____

that are not possible with individual materials.

A disadvantage of composites is that they

are difficult to separate and cannot be easily

_____.

WORD BANK

colours, combining, joined, layering, properties, recycled, shaping, substituted, textures

[3 marks]

10

BLANK PAGE

[Turn over]

02 . 1

Stainless steel pans are shown in FIGURE 2.

FIGURE 2

Give THREE reasons why stainless steel is a suitable material for the pans. [3 marks]

Reason 1 _____

_____

_____

Reason 2 _____

_____

_____

Reason 3 _____

_____

_____

[Turn over]

0 2 . 2

Use notes and sketches to explain how two metal parts can be fastened together using riveting. [4 marks]

_____

_____

_____

_____

_____

_____

[Turn over]

0	2	.	3

A drilling machine is shown in FIGURE 3.

FIGURE 3

Evaluate TWO risks of using this machine. [4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

0 2 . 4

Inside the drilling machine there is a simple gear train.

The driver gear has 85 teeth and the driven gear has 152 teeth.

Calculate the gear ratio.

Show your working.

Give your answer to TWO decimal places. [3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____

| 0 | 2 | . | 5 |

The speed of the drilling machine motor is 1430 rpm.

Calculate the output speed.

Show your working.

Formula:

$$\frac{\text{Speed driver gear}}{\text{Speed driven gear}} = \frac{\text{Number of teeth on driven gear}}{\text{Number of teeth on driver gear}}$$

[2 marks]

_____

_____

_____

_____

_____

_____

Answer _____ rpm

[Turn over]

0 2 . 6

Identify ONE difference between drilling using a pillar drill and drilling using a lathe. [2 marks]

_____

_____

_____

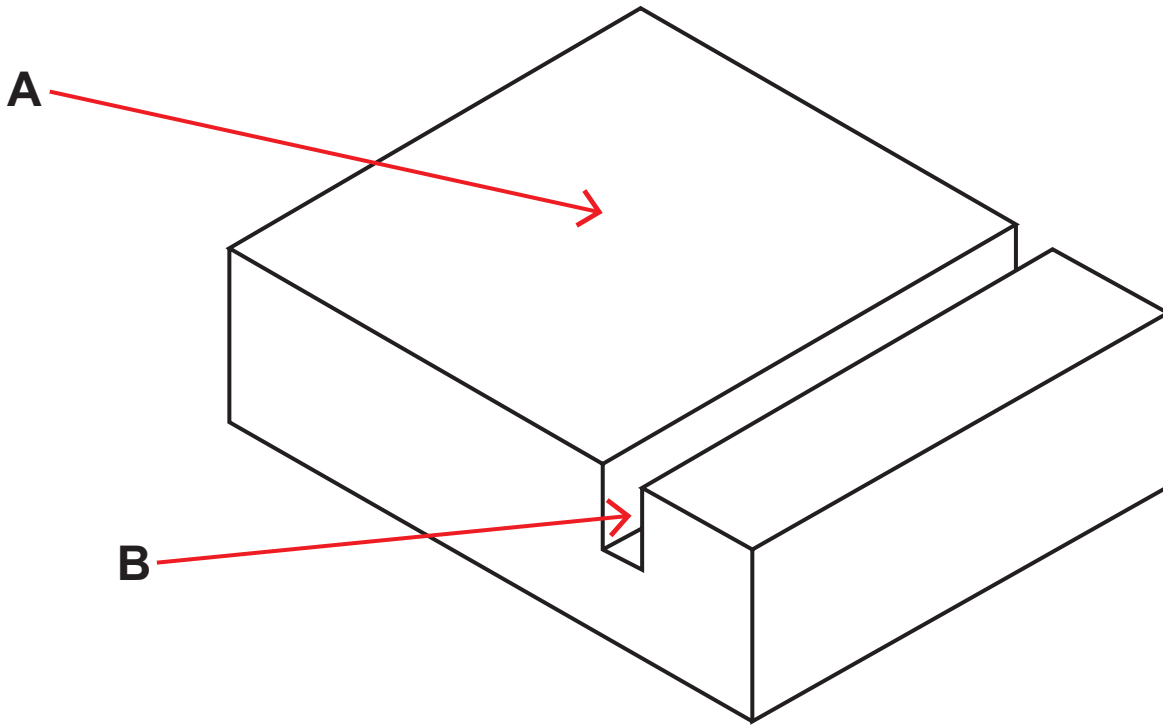_____

_____

BLANK PAGE

[Turn over]

| 0 | 2 | . | 7 |

FIGURE 4 shows a block of material.

FIGURE 4

Name the machining processes used to create the flat surface shown at A and the groove shown at B.
[2 marks]

Flat surface A process

_____

_____

Groove B process

_____

_____

20

[Turn over]

Two bridges made from different materials are shown in FIGURE 5 and FIGURE 6.

FIGURE 5

STRUCTURAL CONCRETE

FIGURE 6

STRUCTURAL TIMBER

[Turn over]

Analyse the suitability of the two materials for constructing a bridge in terms of the following:
[6 marks]

Properties_____

_____

_____

_____

_____

Advantages _____

_____

_____

_____

_____

Disadvantages _____

_____

_____

_____

_____

_____

6

[Turn over]

0 4 . 1

FIGURE 7 shows a greenhouse manufactured using standard forms of material.

FIGURE 7

The manufacturer is considering offering different sizes of greenhouse.

Analyse the manufacturing and cost implications of using standard forms compared to specially made.
[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

0 4 . 2

TABLE 1 shows material costs for a greenhouse.

TABLE 1

MATERIAL	COST	QUANTITY
Aluminium frame	£1.72 per m	47
Polycarbonate panels	£3.06 per panel	32
Fastenings	£7.75 per pack	1

The greenhouse requires 1.5 hours of manufacturing time at £30 per hour.

Calculate the total cost of manufacturing the greenhouse.

Show your working. [4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer £_____

[Turn over]

04.3

The manufacturer estimates that the total cost of the greenhouse would be 37% higher if made from toughened glass panels.

Calculate the TOTAL COST of the greenhouse if toughened glass panels were used.

Show your working. [2 marks]

_____

_____

_____

_____

_____

Answer £_____

BLANK PAGE

[Turn over]

0 4 . 4

Other than cost, evaluate which other factors engineers need to consider when selecting materials.

Give examples in your answer. [6 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

0 4 . 5

Name a suitable production process for shaping polystyrene.

Explain why that process is suitable. [3 marks]

Process _____

_____

Explanation _____

_____

_____

_____

_____

_____

0 4 . 6

Explain the advantages of Fibre Reinforced Polymers (FRP). [2 marks]

_____

_____

_____

_____

_____

_____

21

[Turn over]

0 5

A lathe is shown in FIGURE 8.

FIGURE 8
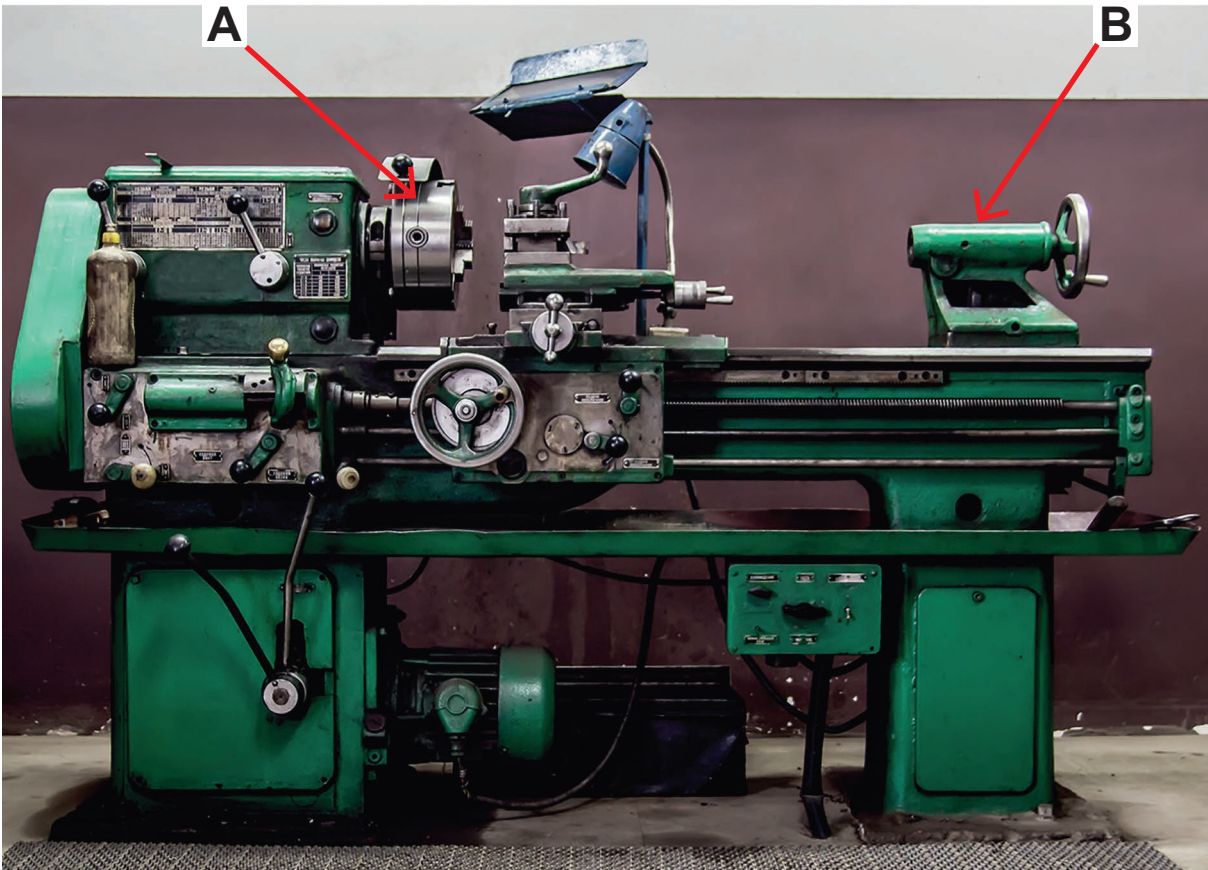
0 5 . 1

Identify the parts of the lathe at A and B. [2 marks]

Part A _____

_____

Part B _____

_____

0 5 . 2

FIGURE 9 shows a tool used on the lathe.

FIGURE 9

Name the tool in FIGURE 9 and explain what it is used for. [2 marks]

Tool name _____

_____

Used for _____

_____

_____

[Turn over]

0 5 . 3

A metal part will be taper turned.

Calculate the angle of the taper shown as θ on FIGURE 10.
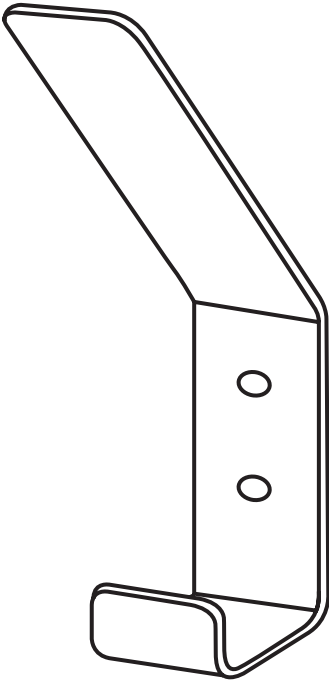
Show your working. [3 marks]

FIGURE 10

22 mm

106 mm

_____

_____

_____

_____

_____

_____

_____

_____
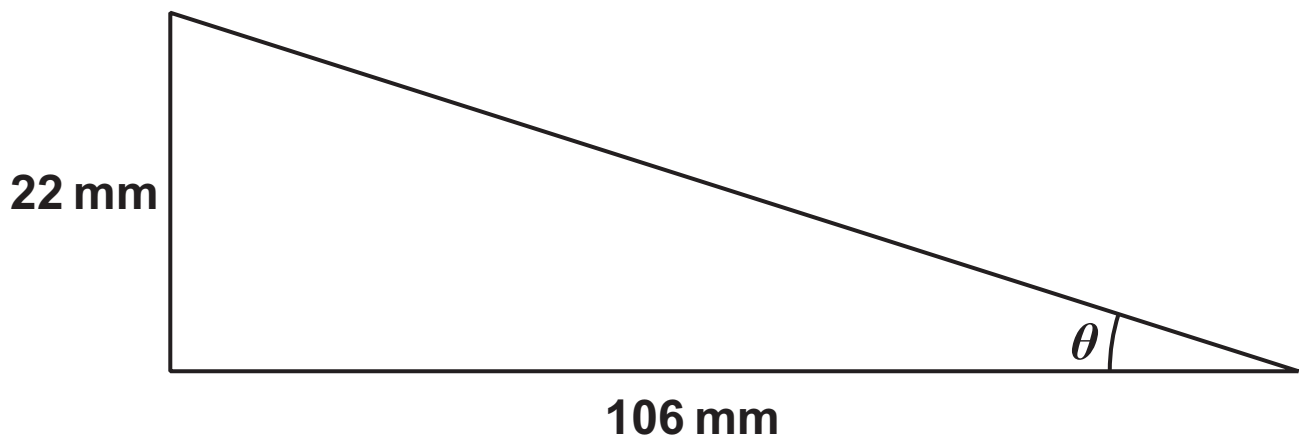
Answer _____ degrees

[Turn over]

| 0 | 5 | . | 4 |

An aluminium coat hook is shown in FIGURE 11.

FIGURE 11

Complete the table opposite to create a production plan to manufacture the coat hook.

Some parts have been completed for you. [6 marks]

ORDER	PROCESS	HAND TOOLS	DESCRIPTION OF PROCESS
1	Mark out the coat hook shape.	Scriber, steel rule	Mark out the size of the coat hook and the position of the holes with a steel ruler and a scriber.
2	Cut out the shape.		
3	Make the holes.	Centre punch, drill	Centre punch the position of the holes. Clamp the work piece and drill through the material.
4	Refine the edges and holes.		
5	Bend to correct angle.		

0	5	.	5

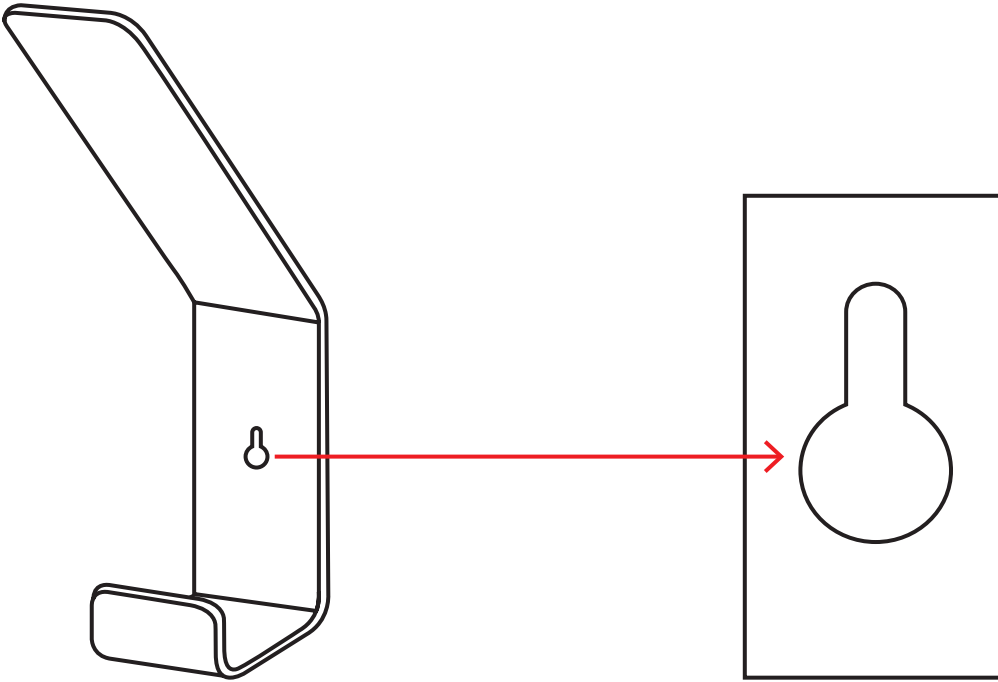**A fixing hole in the coat hook is changed to the shape shown in FIGURE 12.**

FIGURE 12

Name TWO machining processes that could be used to cut out the fixing hole shape. [2 marks]
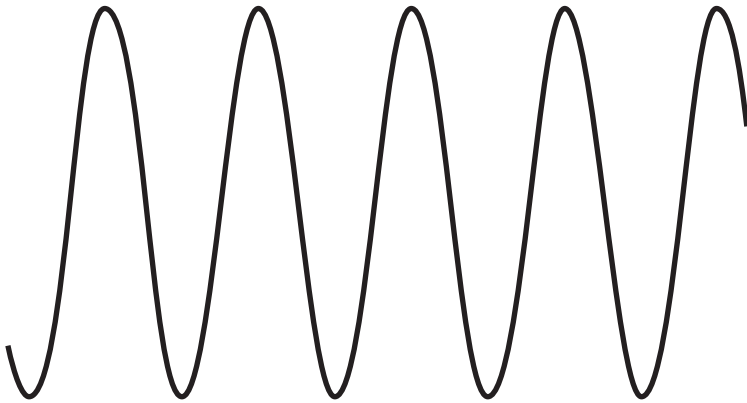
Process 1 _____

_____

Process 2 _____

_____

15

BLANK PAGE

0 6 . 1

A sine wave is shown in FIGURE 13.

FIGURE 13

Does the sine wave represent an analogue or digital signal? [1 mark]

_____

_____

0 6 . 2

Name ONE benefit of using a piezo sounder rather than a buzzer in a circuit. [1 mark]

_____

_____

_____

0 6 . 3

Describe how an engineer would predict performance in an electronic circuit. [2 marks]

_____

_____

_____

_____

_____

_____

[Turn over]

0	6	.	4

A circuit for a light emitting diode (LED) contains a 250 Ω resistor and the voltage is 6 V.

Calculate the current flowing through the circuit.

Use the formula V = I × R

Give your answer to THREE decimal places. [4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer with unit _____

0 6 . 5

**Explain why a resistor is required in the LED circuit.
[2 marks]**

_____

_____

_____

_____

_____

0 6 . 6

**Give one example of when an Analogue to Digital
Conversion (ADC) is used. [2 marks]**

_____

_____

_____

_____

_____

[Turn over]
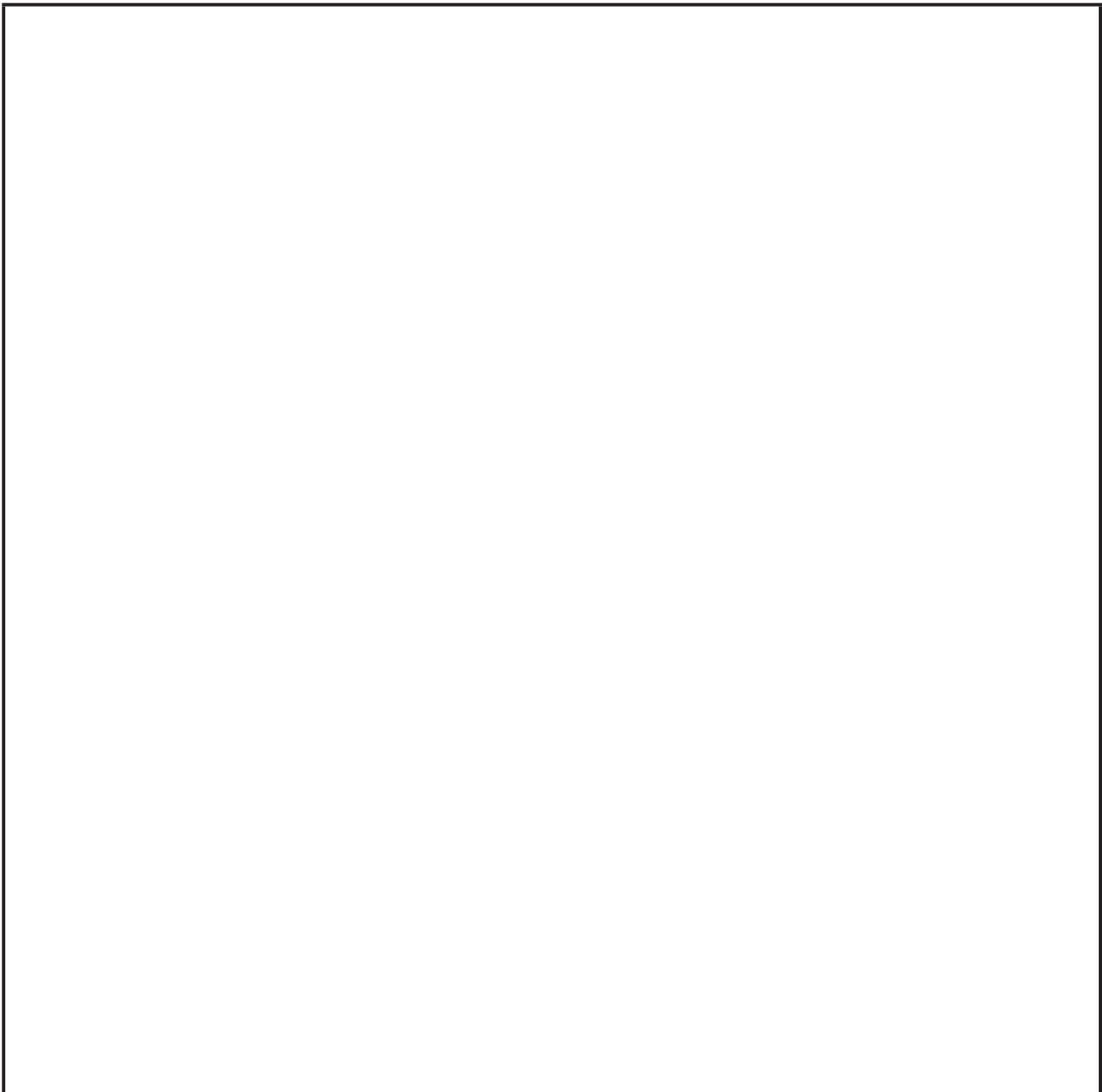
| 0 | 6 | . | 7 |

A system is designed to operate a motorised window blind.

The system consists of a motor, light sensor, a microcontroller and a Field Effect Transistor (FET).

In the space below, draw a systems diagram to show the operation of the motorised window blind. [6 marks]

0	6	.	8

Analyse the use of a motorised window blind system rather than a manually operated one. [2 marks]

_____

_____

_____

_____

_____

_____

20

[Turn over]

0 7 . 1

**Name ONE non-renewable form of energy production.
[1 mark]**

_____

_____

_____

0 7 . 2

Tidal energy and wind energy are two methods of renewable energy production.

Compare the use of the two energy methods.

Discuss the following aspects in your answer:

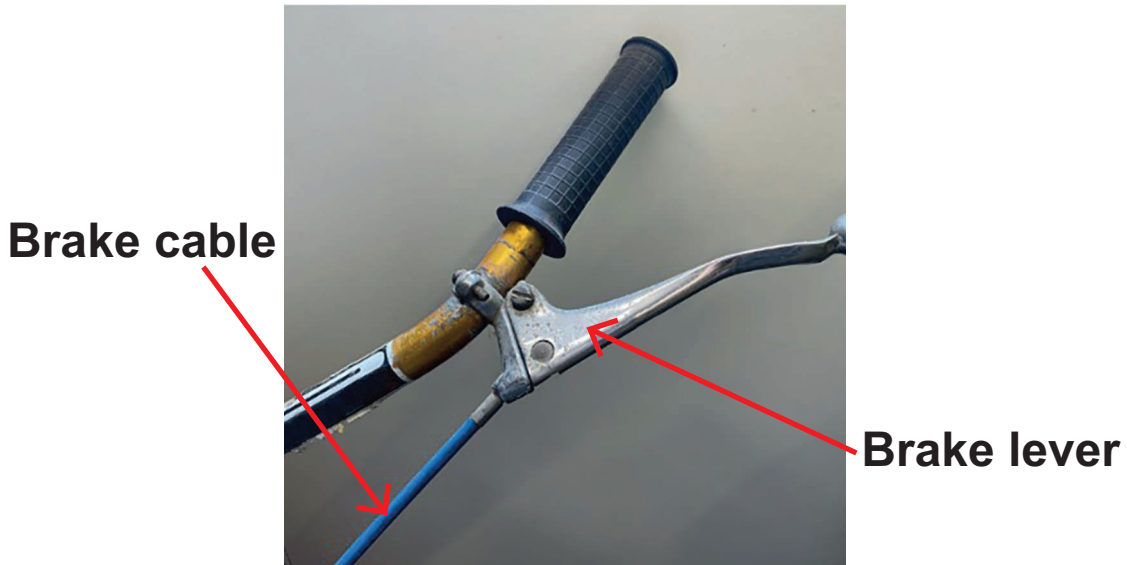- **advantages and disadvantages**
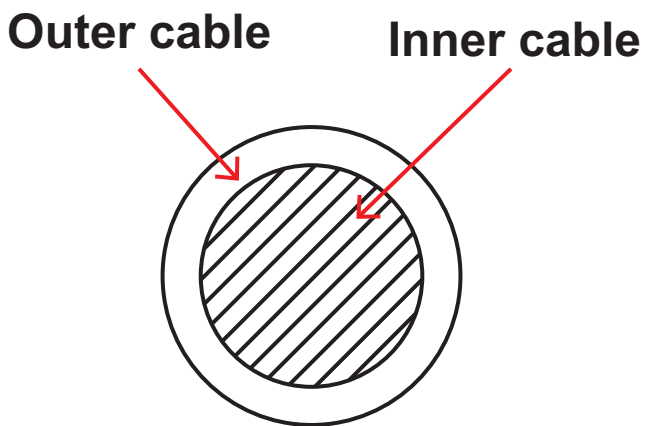
- **impact on the environment.**

[8 marks]

_____

_____

_____

_____

_____

08.1

FIGURE 14 shows a brake lever and cable.

FIGURE 14

Brake cable

Brake lever

Cross section of brake cable

Outer cable

Inner cable

The inner cable has a diameter of 1.6 mm. The force applied by the lever is 70 N.

Calculate the stress applied to the inner cable when the lever is pulled.

Formula: Stress = Force/Cross section area

Cross section area = πr^2

[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

_____

_____

_____

Answer _____ **N/mm^2**

BLANK PAGE

[Turn over]

08.2

State which force is applied to the inner cable when the brake lever is pulled. [1 mark]

_____

_____

_____

08.3

The manufacturer must test the inner cable to determine how much it stretches.

On page 61, using notes and sketches, design a test that would assess this property of the inner cable. [6 marks]
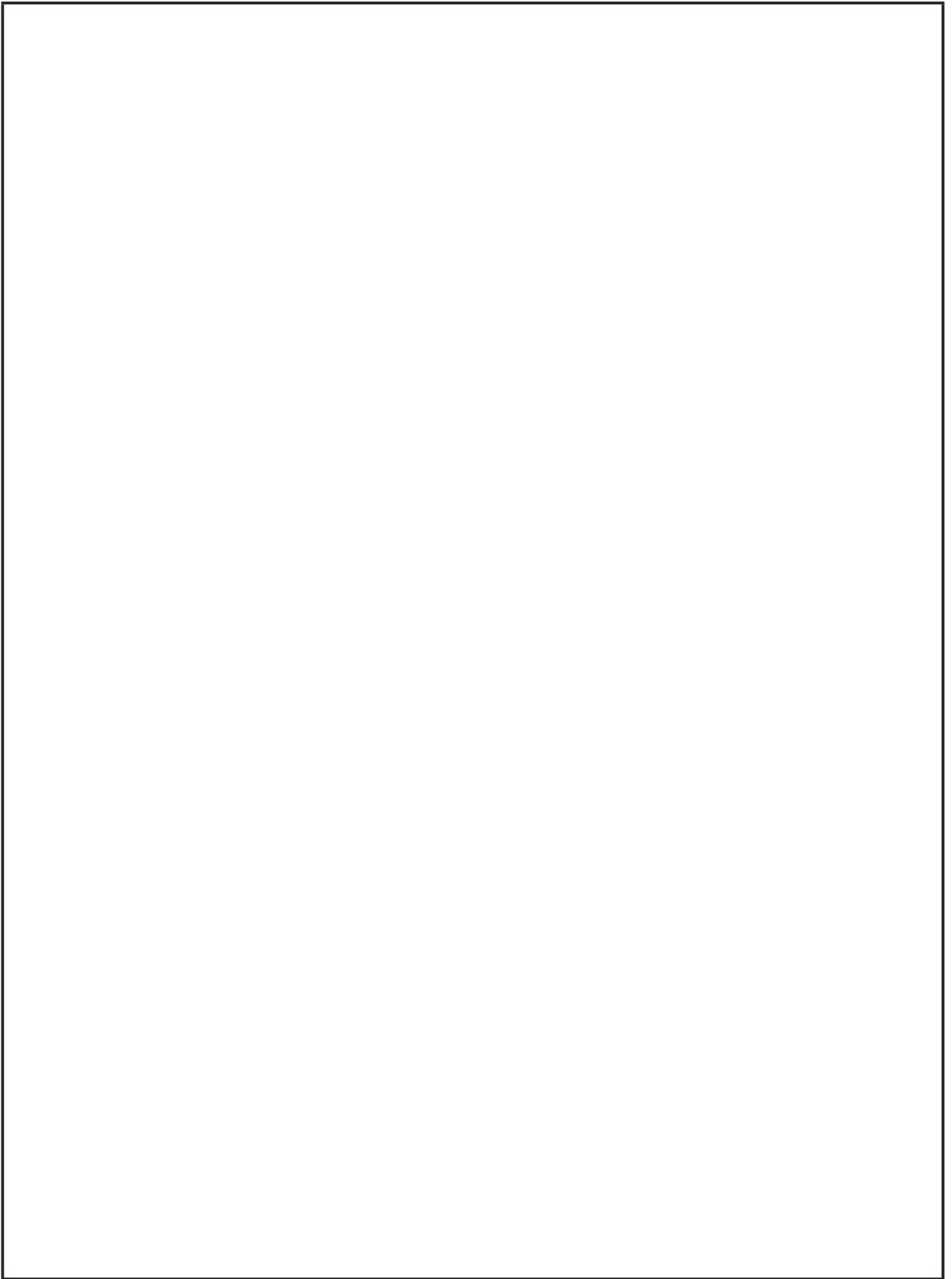
| 0 | 8 | . | 4 |

TABLE 2 shows the results of testing when increasing force is applied to the inner cable.

TABLE 2

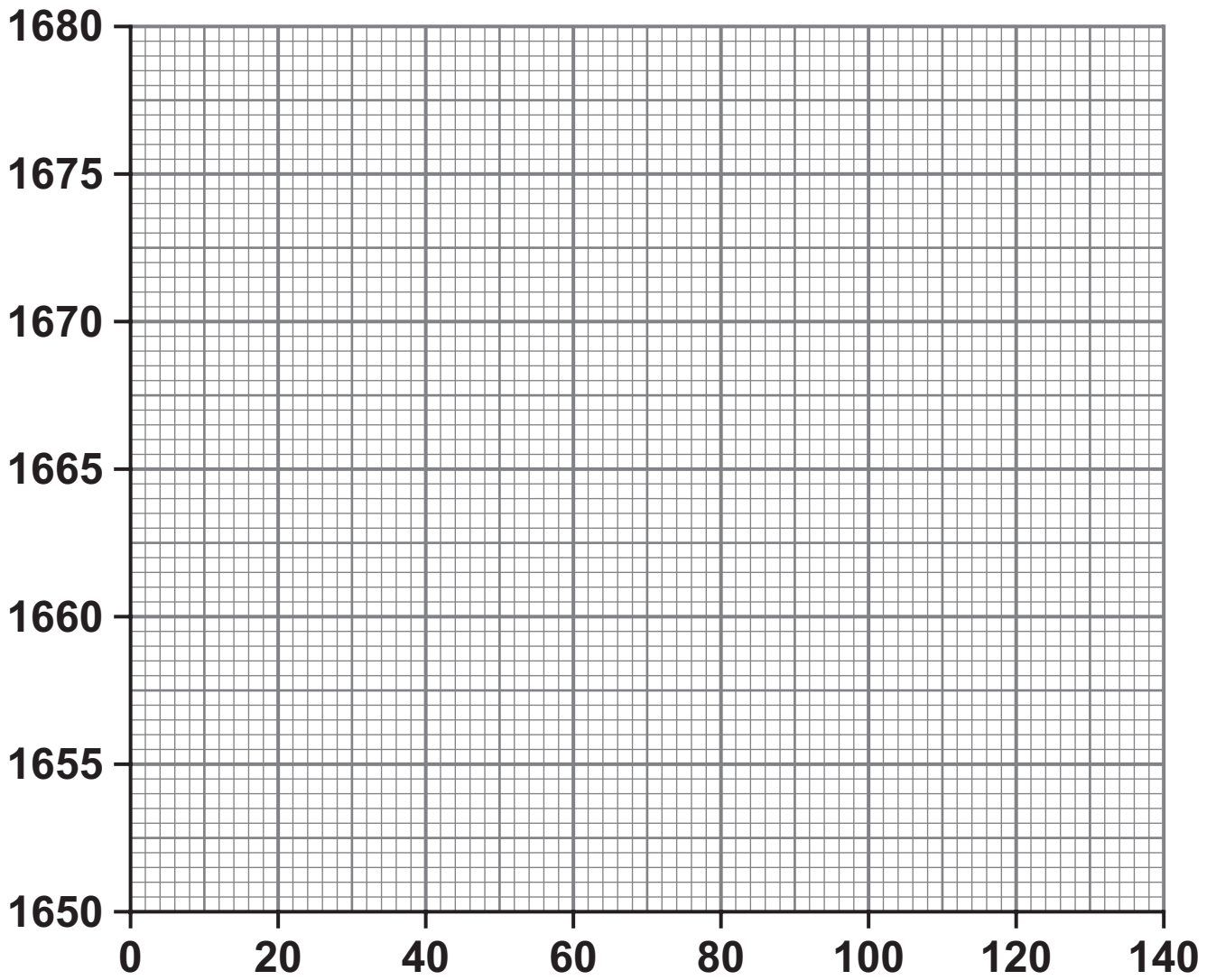| Force in N	20	40	60	80	100	120
Length in mm	1650	1652	1655	1659	1664	1670

Using the data in TABLE 2, plot a graph opposite to show the relationship between the force applied and the change in length.

Marks will be awarded for:

- **labelling the axes**

- **plotting the data onto the graph**

- **drawing a line to connect the plotted data.**

[4 marks]

0	8	.	5

Predict the length of the inner cable if a force of 110 N is applied. [1 mark]

_____

_____

Answer _____ mm

0	8	.	6

State the material property that allows the inner cable to stretch when a force is applied. [1 mark]

_____

_____

_____

16

0 9 . 1

**Name ONE example of a rapid prototyping process.
[1 mark]**

_____

_____

_____

0 9 . 2

**Give TWO advantages of using a rapid
prototyping process. [2 marks]**

Advantage 1 _____

_____

_____

Advantage 2 _____

_____

_____

3

END OF QUESTIONS

Additional page, if required.
Write the question numbers in the left-hand margin.

Additional page, if required.
Write the question numbers in the left-hand margin.

Additional page, if required.
Write the question numbers in the left-hand margin.

Additional page, if required.
Write the question numbers in the left-hand margin.

BLANK PAGE

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

70

226G8852/W