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Centre number

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Candidate number

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Candidate signature

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I declare this is my own work.

# GCSE ENGINEERING

## Unit 1 Written Paper

Tuesday 20 June 2023

Morning

Time allowed: 2 hours

### Materials

For this paper you must have:

- normal writing and drawing instruments
- a calculator.

### Instructions

- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or 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.

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



J U N 2 3 8 8 5 2 W 0 1

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**8852/W**

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 **one** of the following properties allows a material to resist wear and abrasion?

[1 mark]

A Ductility

B Hardness

C Malleability

D Toughness

0 1 . 2

Which **one** of the following metals is an alloy?

[1 mark]

A Brass

B Copper

C Iron

D Zinc



**0 1 . 3** Which of the stock forms listed below does **not** apply to metal?

**[1 mark]**

- A** Bar
- B** Board
- C** Rod
- D** Sheet

**0 1 . 4** Which one of the following properties could be used to describe Lead?

**[1 mark]**

- A** Brittle
- B** Highly conductive
- C** Malleable
- D** Tough

**0 1 . 5** What type of electronic device is a comparator?

**[1 mark]**

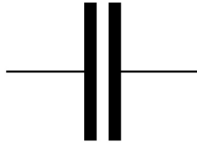
- A** Input
- B** Output
- C** Process
- D** Programmable

**Question 1 continues on the next page**

**Turn over ►**



0 1 . 6 Name the circuit symbol shown below.



[1 mark]

A Battery

B Capacitor

C Diode

D Switch

0 1 . 7 Fibre reinforced polymer (FRP) is an example of which type of material?

[1 mark]

A Alloy

B Composite

C Textile

D Timber



0 1 . 8

Use the word bank provided to complete the following statements.

There are two types of polymers, thermoplastics and \_\_\_\_\_  
polymers.

When thermoplastics are heated, they become soft and \_\_\_\_\_,  
allowing them to be formed into a range of products.

Thermoplastic products can be easily \_\_\_\_\_ at the end of  
their lifecycle.

**Word bank**

burnt, disposed of, flexible, hard, recycled, shaped, thermoforming, thermosetting

**[3 marks]**

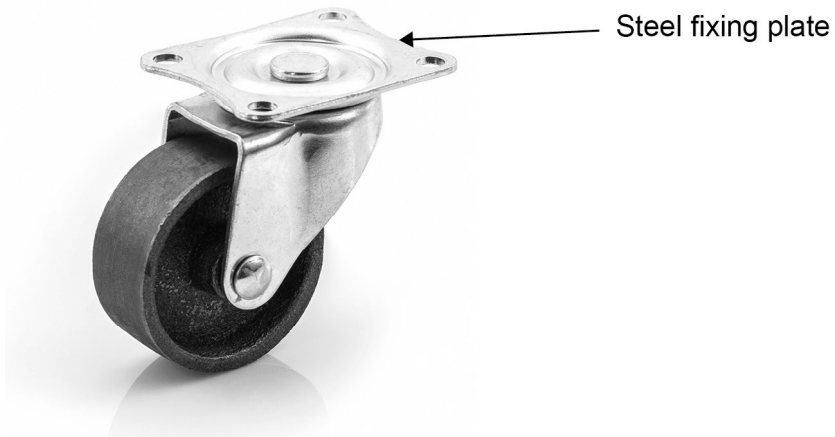
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**Turn over for the next question****Turn over ►**

0 2 . 1

Figure 1 shows a castor wheel with a steel fixing plate.

Figure 1



The fixing plate has been press formed. Using notes and sketches, describe the press forming process in the space below.

[6 marks]



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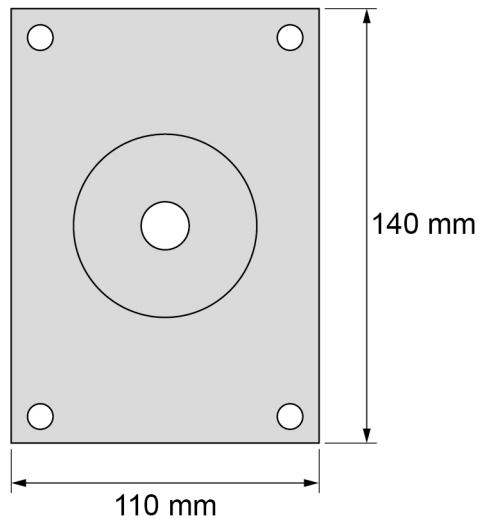
**Question 2 continues on the next page**

**Turn over ▶**



0 2 . 2 Figure 2 shows a drawing of the steel fixing plate.

Figure 2



Work out the maximum number of whole fixing plates that could be made from a sheet of steel measuring  $0.5 \text{ m} \times 0.5 \text{ m}$ .

Show your working.

[4 marks]

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Answer \_\_\_\_\_





**0 2 . 3**

In a pneumatic press forming system, the output cylinder has a radius of 32 mm.

Calculate the air pressure necessary for the cylinder to deliver a force of 15 605 newtons.

Use the equation  $P = F/A$

Show your working.

**[4 marks]**

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Answer \_\_\_\_\_ N/m<sup>2</sup>

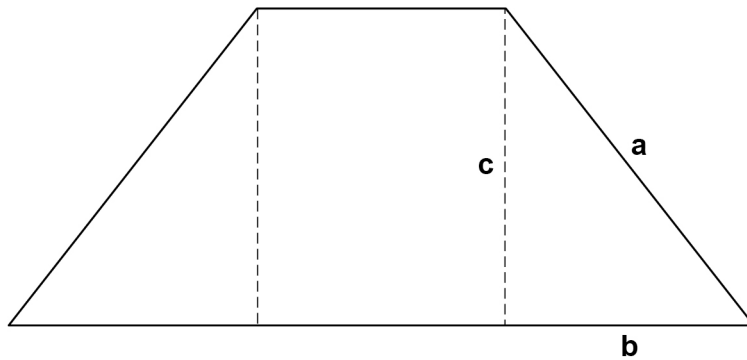
**Question 2 continues on the next page**

**Turn over ►**

0 2 . 4

**Figure 3** shows a castor wheel housing as a development (net).

**Figure 3**



Calculate the length of the side shown at **a**.

$$b = 135 \text{ mm}$$

$$c = 156 \text{ mm}$$

Use the formula  $a^2 = b^2 + c^2$

**[4 marks]**

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Answer **a** = \_\_\_\_\_ mm



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0 2 . 5

The manufacturer has decided that the castor wheel housing needs to have a surface finish applied. The manufacturer can choose painting or dip coating.

Evaluate the advantages and disadvantages of each method.

[8 marks]

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0 2 . 6

Name **one** suitable finish for the castor wheel housing other than painting or dip coating.

[1 mark]

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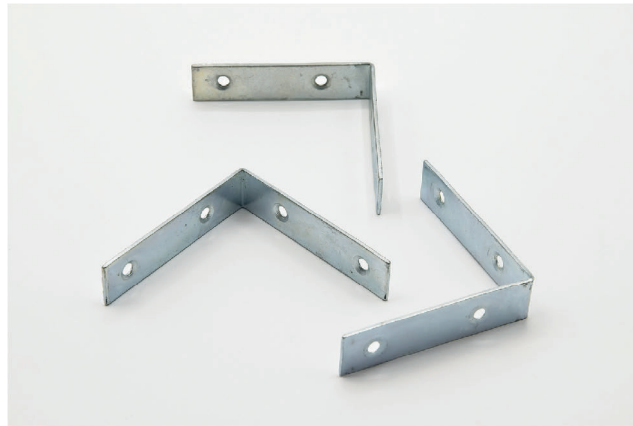
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**0 4 . 1** Figure 4 shows a corner bracket manufactured from low carbon steel.

**Figure 4**



One bracket will be made in a school workshop.

Complete the production plan below by giving the names of tools or equipment to be used for each stage.

**[5 marks]**

Stage	Tool/equipment
Mark out the size and the position of the holes	
Cut the metal to size	
Finish the cut edges	
Make the holes	
Bend the metal shape to 90 degrees	

**0 4 . 2** Describe the difference between brazing and welding.

**[2 marks]**

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**Turn over ►**



0 4 . 3

Figure 5 shows cylindrical aluminium components.

Figure 5



Name **one** process that can be used to produce these aluminium components.

[1 mark]

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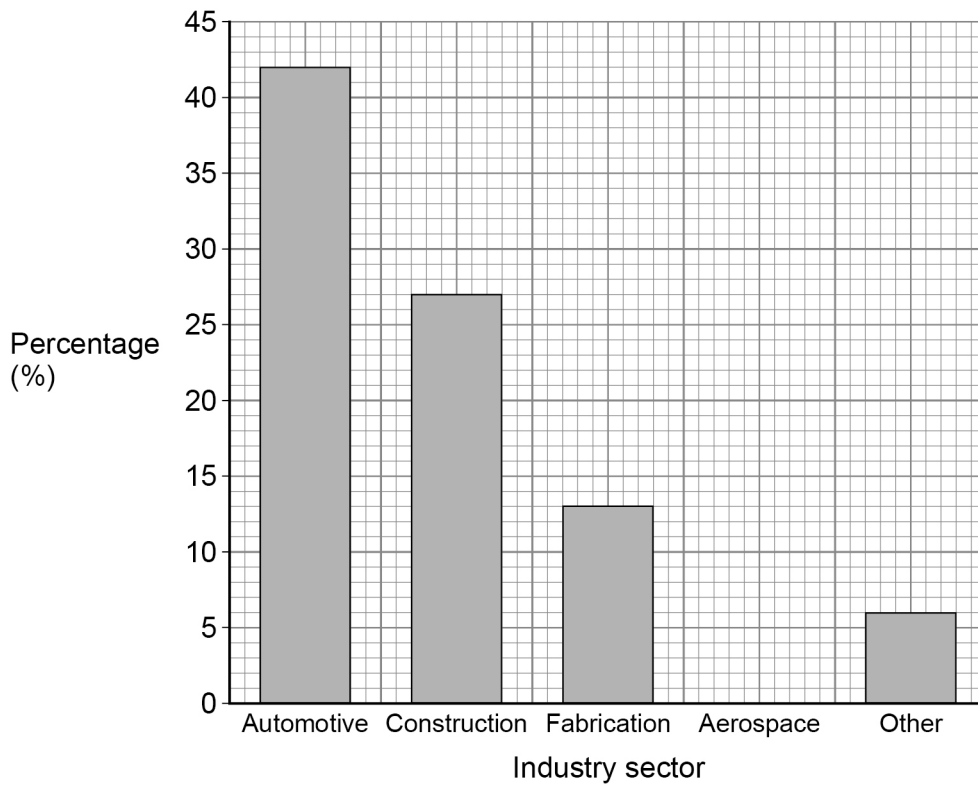
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The engineering company has collected data on industry sectors that buy their products. **Figure 6** shows an incomplete bar chart with the results.

**Figure 6**



**0 5 . 2** Aerospace is missing from the bar chart.

Calculate the percentage for the Aerospace industry.

Show your working.

**[2 marks]**

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Aerospace industry % = \_\_\_\_\_

**0 5 . 3** Complete the graph by adding the Aerospace bar.

**[1 mark]**





**0 5 . 4** The total value of all sales is £18 million.

Calculate the value of Construction industry sales.

Show your working.

**[2 marks]**

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Answer £ \_\_\_\_\_

**11**

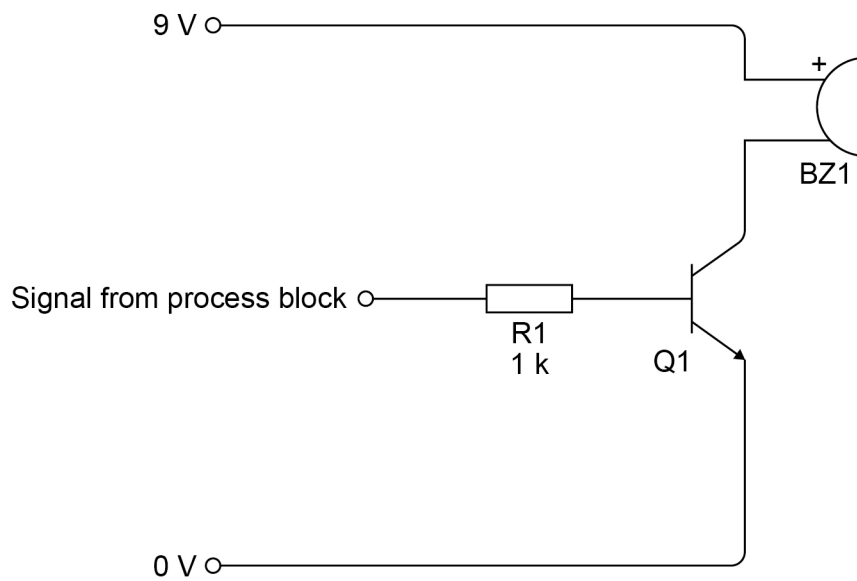
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**0 6 . 1** Figure 7 shows a simple buzzer circuit.

**Figure 7**



State the function of the transistor within the circuit.

**[1 mark]**

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**0 6 . 2** Name **one** audible output device that could be used instead of the buzzer.

**[1 mark]**

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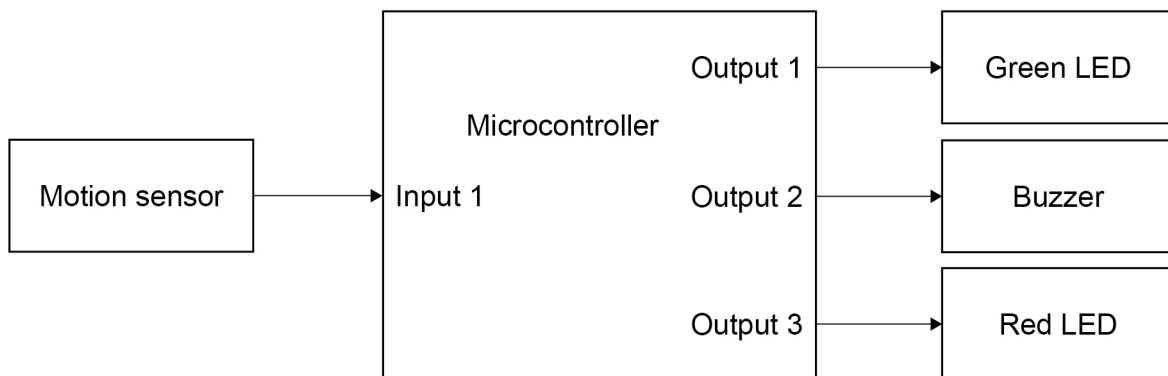


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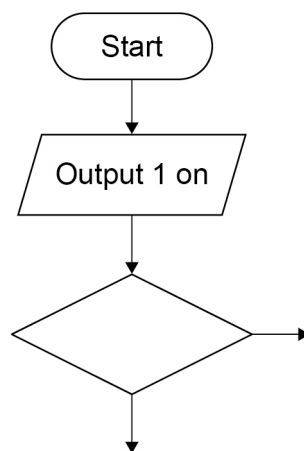
06.3

The buzzer will be used in an alarm system. **Figure 8** shows the system diagram for the alarm system.

**Figure 8**

- Output 1, the green LED is on.
- When the motion sensor is activated, the green LED goes off, a red LED comes on for 30 seconds and the buzzer sounds for 30 seconds.
- The red LED turns off, the green LED turns back on and the buzzer stops.
- The system works whenever the motion sensor is activated.

Complete the flowchart in the space below so that the system works as stated.

**[6 marks]****Turn over ►**

**0 6 . 4** Give **two** advantages of writing an electronic program as a flowchart.

**[2 marks]**

Advantage 1 \_\_\_\_\_

\_\_\_\_\_

Advantage 2 \_\_\_\_\_

\_\_\_\_\_

**0 6 . 5** Explain the difference between an AC and DC power supply. Use notes and/or sketches in your answer.

**[2 marks]**

\_\_\_\_\_

\_\_\_\_\_

**0 6 . 6** Name **two** advantages of using batteries as a power supply rather than mains electricity.

**[2 marks]**

Advantage 1 \_\_\_\_\_

\_\_\_\_\_

Advantage 2 \_\_\_\_\_

\_\_\_\_\_



0 6 . 7 Name **one** type of logic gate.

[1 mark]

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0 6 . 8 Give the function of the logic gate you have named.

[1 mark]

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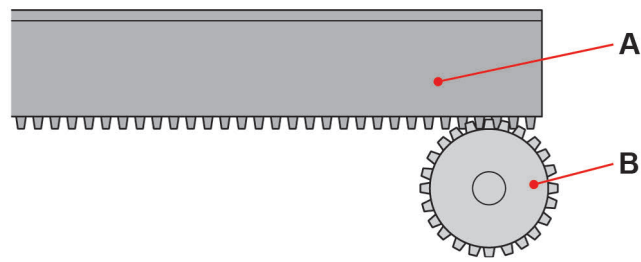
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**Turn over ►**



0 7 . 1 **Figure 9** shows a rack and pinion mechanism.

**Figure 9**



Complete the sentences below.

**[2 marks]**

The motion at point **A** is \_\_\_\_\_ .

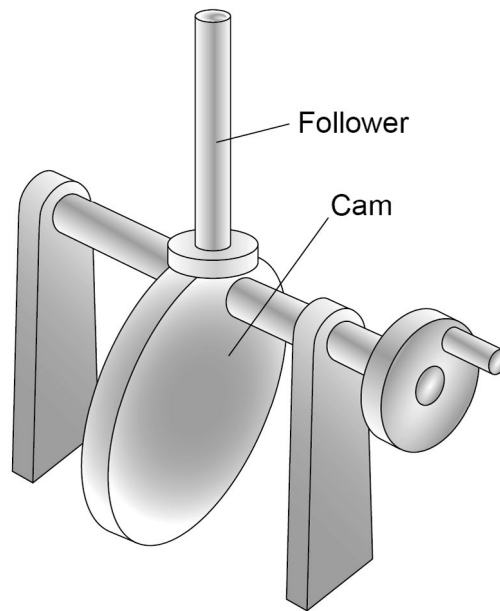
This is converted to \_\_\_\_\_ motion at point **B**.



0 7 . 2

Figure 10 shows a simple cam and follower mechanism.

Figure 10



Explain the function of the follower.

[2 marks]

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Question 7 continues on the next page

Turn over ►



**0 7 . 3**Give **two** reasons why machinery needs to be regularly maintained.**[2 marks]**

Reason 1 \_\_\_\_\_

\_\_\_\_\_

Reason 2 \_\_\_\_\_

\_\_\_\_\_

**0 7 . 4**Discuss **two** reasons why moving parts in machinery need to be lubricated.**[4 marks]**

Reason 1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Reason 2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

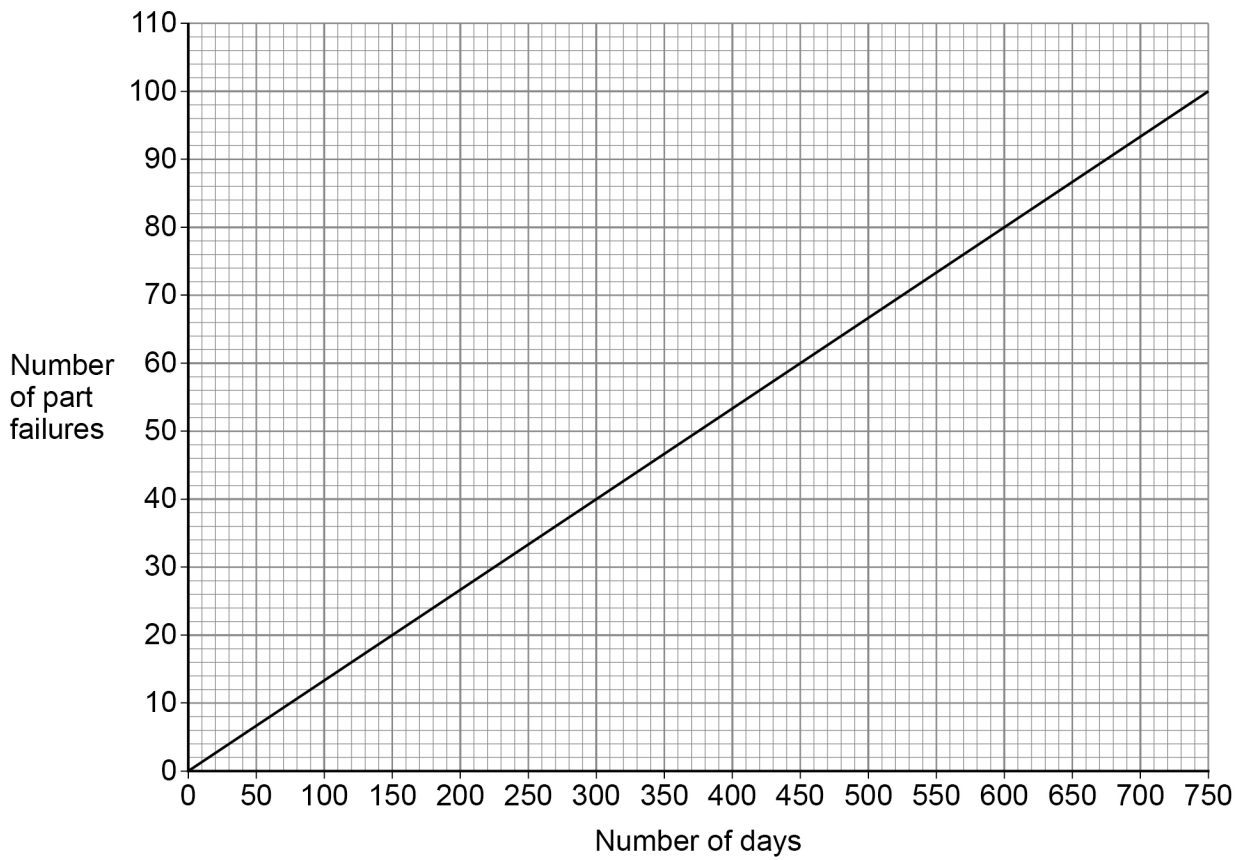
\_\_\_\_\_





**Figure 11** shows data the engineering company have collected on how long a machine part lasts before failing.

**Figure 11**



**0 7 . 5** Calculate the slope of the graph at 300 days.

Show your working.

**[2 marks]**

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**Turn over ►**



**0 7 . 6** A mechanical component is shown in **Figure 12**.

**Figure 12**



Name the component.

**[1 mark]**

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**0 7 . 7** State the function of the component.

**[1 mark]**

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0 8 . 1

A length of metal wire is 300 mm long. When a load is suspended from the wire, it stretches by 2.5 mm.

Calculate the strain in the wire.

[3 marks]

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0 8 . 2

When a stress of 2.2 N/mm<sup>2</sup> is applied to the metal wire, the strain produced is 0.019

Calculate the Young's modulus of the wire material.

Use the formula Young's modulus  $E = \text{Stress/strain}$  or  $E = \sigma/\epsilon$

Give your answer to one decimal place.

[2 marks]

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Answer \_\_\_\_\_ N/mm<sup>2</sup>

0 8 . 3

Name the type of strength the cable in a pulley system must have.

[1 mark]

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Question 8 continues on the next page

Turn over ►



0 8 . 4

Describe how the strength of the pulley cable could be tested.

[2 marks]

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0 8 . 5

State the **two** main functions of a pulley system.

[2 marks]

Function 1 \_\_\_\_\_

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Function 2 \_\_\_\_\_

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**0 9 . 1**

Components can be manufactured using rapid prototyping (3D Printing) methods.

Analyse the advantages and disadvantages of using this method to manufacture components.

**[8 marks]**

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**Question 9 continues on the next page**

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**0 9 . 2**

Give **two** examples of how quality control methods could be applied to manufactured components.

**[4 marks]**

Method 1 \_\_\_\_\_

Used for \_\_\_\_\_

\_\_\_\_\_

Method 2 \_\_\_\_\_

Used for \_\_\_\_\_

\_\_\_\_\_

**0 9 . 3**

A component has a length of 150 mm. The length must be manufactured with a tolerance of  $\pm 2\%$ .

Calculate the maximum and minimum acceptable lengths.

Show your working.

**[3 marks]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Minimum \_\_\_\_\_ mm

Maximum \_\_\_\_\_ mm

**15****END OF QUESTIONS**

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