AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
ENGINEERING

Unit 1 Written Paper

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	
10	
11	
12	
TOTAL	

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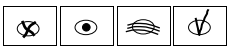
Answer **all** questions in the spaces provided.

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 The list below shows a range of different metals.

Shade **two** circles to identify the metals that are ferrous.

[2 marks]

A Aluminium ⬭

B Bronze ⬭

C Cast iron ⬭

D Copper ⬭

E Lead ⬭

F Low carbon steel ⬭

0 1 . 2 Which **one** of the following properties allows a material to absorb impact without breaking?

[1 mark]

A Ductility ⬭

B Hardness ⬭

C Plasticity ⬭

D Toughness ⬭

Do not write outside the box

0 1 . 3 Complete the following statement using the word bank provided.

Ceramic materials have many engineering applications.

They are very good _____ for both electricity and heat.

However, a disadvantage is _____ .

Ceramic products are usually made by _____ processes.

Word bank

brittleness, conductors, corrosion resistance, insulators, machining, malleability, melting, moulding, tools

[3 marks]

0 1 . 4 Which category of testing includes a compressive strength test?

[1 mark]

A Destructive ⬭

B Electrical ⬭

C Hardness ⬭

D Visual ⬭

0 1 . 5 Which force directly opposes the weight of an aeroplane and holds the aeroplane in the air?

[1 mark]

A Drag ⬭

B Friction ⬭

C Lift ⬭

D Thrust ⬭

Do not write outside the box

0 1 . 6 Which heat treatment process applied to steel involves cooling at room temperature?

[1 mark]

A Annealing ⬭

B Hardening ⬭

C Normalising ⬭

D Tempering ⬭

0 1 . 7 Which component reduces current flow in an electronic system?

[1 mark]

A Capacitor ⬭

B Diode ⬭

C Resistor ⬭

D Transistor ⬭

10

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0 2 . 1 Composite materials have many engineering applications.

Complete **Table 1** to create a chart showing the properties and applications of composite materials.

Some parts have been completed for you.

[3 marks]

Table 1

Composite	**Property**	**Application**
Glass reinforced polymer		Canoes, boat hulls
Medium Density Fibreboard	Smooth surface, easily machined and painted	
	Reinforced with steel bars for tensile strength	Bridges and buildings

0 2 . 2 Give **two** reasons why a composite material would be chosen over other materials.

[2 marks]

1 _____

_____

2 _____

_____

5

Turn over ►

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0 3 . 1 Sand-casting is a process used to make metal components.

Identify the **four** main stages of the sand-casting process.

[4 marks]

Stage 1 _____

_____

Stage 2 _____

_____

Stage 3 _____

_____

Stage 4 _____

_____

0 3 . 2 Engineering uses precision casting. An example might be an engine block.

Select **one** casting method other than sand casting that is suitable for manufacturing the engine.

Give reasons for using this production method.

[4 marks]

My chosen method _____

_____

_____

_____

_____

_____

_____

_____

_____

Do not write outside the box

0 3 . 3 An aluminium casting is 550 mm long, 320 mm wide and 350 mm high.

The density of the aluminium is 0.0027 g/mm^3

Use the equation given below to calculate the mass of the casting in kilograms (kg).

Density = mass/volume ($p = m/v$)

Show your working.

[4 marks]

Answer _____ kg

12

Turn over for the next question

Do not write outside the box

0 4 . 1 Give **two** advantages and disadvantages of a **thermosetting** polymer used to manufacture an electrical socket.

[4 marks]

Advantage 1 _____

_____

Advantage 2 _____

_____

Disadvantage 1 _____

_____

Disadvantage 2 _____

_____

0 4 . 2 Name **one** suitable manufacturing process for products made from **thermoplastic** polymers.

Describe the process.

[3 marks]

Name of process _____

Description _____

_____

_____

_____

_____

_____

Do not write outside the box

0 4 . 3 Polycarbonate is a thermoplastic polymer commonly used for safety glasses.

Explain **two** of the properties of polycarbonate that make it a suitable material for this product.

[4 marks]

Property 1 _____

_____

_____

_____

Property 2 _____

_____

_____

_____

11

Turn over for the next question

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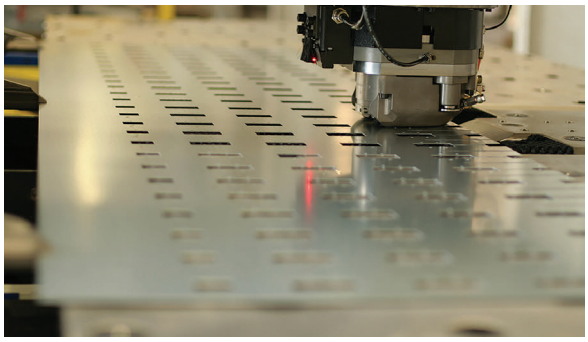
0 5 . 1 Explain the difference between a pneumatic system and a hydraulic system.

[2 marks]

0 5 . 2 **Figure 1** shows an automated punch press.

Figure 1



Analyse the suitability of a hydraulic system **or** a pneumatic system as a method to power the automated punch press.

Select **one** method and give reasons for your choice.

[4 marks]

My chosen method _____

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Question 5 continues on the next page

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ANSWER IN THE SPACES PROVIDED

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0 5 . 3 The automated punch press could be used to manufacture an aluminium grille.

Figure 2 shows the number of triangles that are punched out of the aluminium to make the grille.

Figure 3 shows the sizes of the triangles.

Figure 2

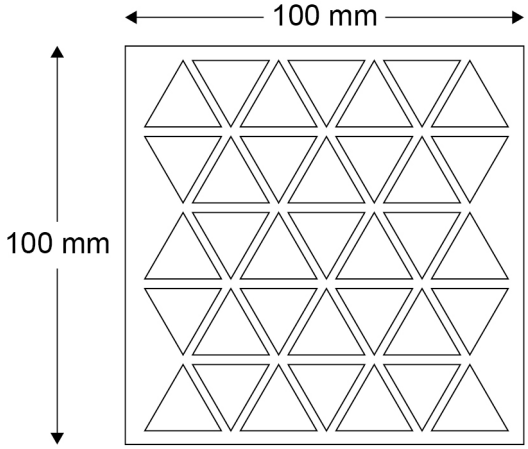

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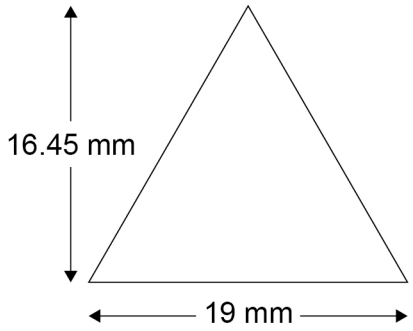
Figure 3



Not drawn accurately

Calculate the total area of the punched triangles.

Show your working.

Give your answer in mm^2

[3 marks]

Answer _____ mm^2

Do not write outside the box

0 5 . 4 Calculate the amount of aluminium remaining after the triangles have been punched.

[2 marks]

Answer _____ mm^2

0 5 . 5 Name **one** suitable surface finishing process that could be applied to the aluminium grille and **one** reason for using it.

[2 marks]

Process _____

Reason _____

Question 5 continues on the next page

Do not write outside the box

0 5 . 6 To make one complete aluminium grille, the manufacturer uses:

- 0.38 m² of sheet material
- 4 rivets
- 1 surround.

The cost of materials is shown in **Table 2**.

Table 2

Item	**Cost each**
Sheet material	£3.15 per m²
Rivets	1.5p
Surround	£1.87

The labour cost of each unit is £2.58

Calculate the cost of each complete grille.

Show your working.

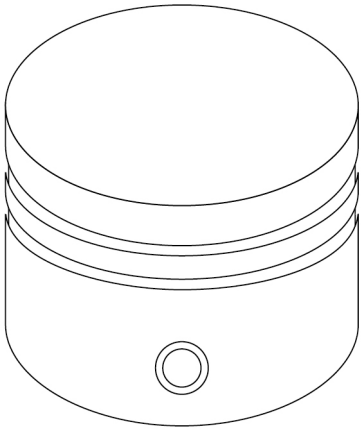
[2 marks]

Answer £ _____

Do not write outside the box

0 5 . 7 **Figure 4** shows a cylindrical piston which is part of the punch press.

Figure 4



The radius of the piston is 30 mm.

The pressure applied is 1.5 N/mm^2

Calculate the force applied to the sheet material.

Use pi (π) = 3.142

Show your working.

[4 marks]

Formula _____

Answer _____ N

19

Turn over ►

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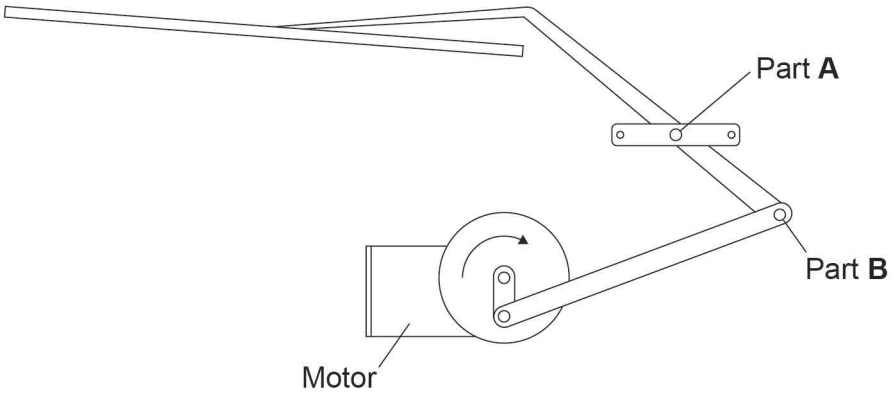
0 6 A windscreen wiper is shown in **Figure 5**.

Figure 5

Figure 6 shows a diagram of a windscreen wiper mechanism.

Figure 6



0 6 . 1 Identify the points at Part **A** and Part **B**.

[2 marks]

Part **A** _____

_____

Part **B** _____

_____

0 6 . 2 The linkage on the windscreen wiper mechanism converts rotary motion to which other type of motion?

[1 mark]

_____

Do not write outside the box

0 6 . 3 **Figure 7** shows a sliding gate.

Figure 7

Name a mechanism that will open and close the sliding gate.

Use notes and sketches to explain how the mechanism operates.

[5 marks]

Name of mechanism _____

8

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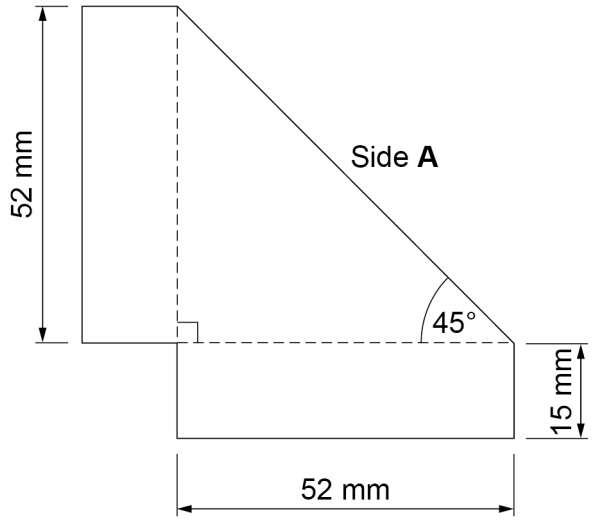
0 7 . 1 A corner plate is shown in **Figure 8**.

Figure 8



Calculate the total area of the corner plate.

Show your working.

[2 marks]

Answer _____ mm^2

Do not write outside the box

0 7 . 2 Calculate the length of Side **A** shown in **Figure 8**.

Show your working.

[3 marks]

Answer _____ mm

5

Turn over for the next question

Do not write outside the box

0 8 Chemical etching is a process used to manufacture Printed Circuit Boards (PCBs).

Evaluate the risks of using this process.

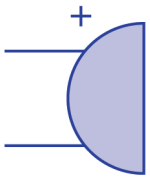
[4 marks]

4

Do not write outside the box

0 9 . 1 **Figure 9** shows a circuit symbol for a buzzer.

Figure 9



What type of device is a buzzer?

[1 mark]

0 9 . 2 Calculate the value of the resistor needed if the maximum current draw for a lamp is 20 mA and the voltage is 6 V.

Give the units with your answer.

[3 marks]

Formula used _____

Answer _____

Question 9 continues on the next page

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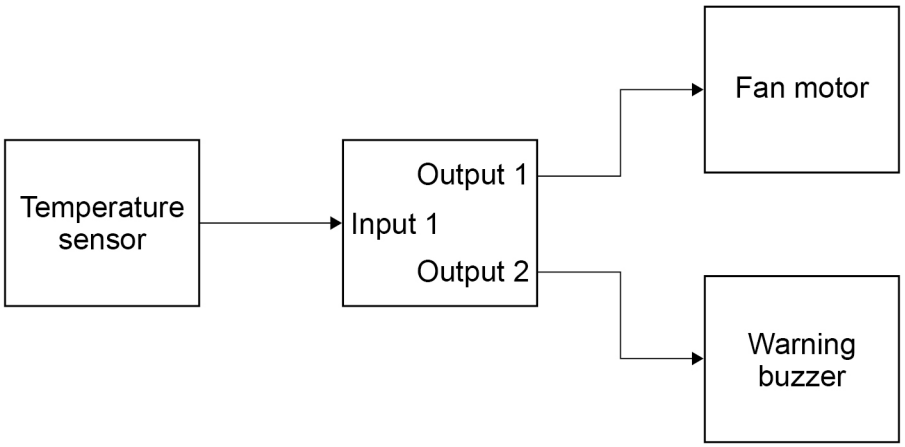
0 9 . 3 **Figure 10** is a block diagram of a cooling system that monitors the temperature of a device.

Figure 10



Complete the flow chart on **page 23** so that the system works in the following way:

- output 1 (Fan motor) switches on when the temperature reaches 25° C
- output 2 (Warning buzzer) switches on for thirty seconds when the temperature of the system reaches 30° C
- the program is always running.

Some parts of the program have been completed for you.

[6 marks]

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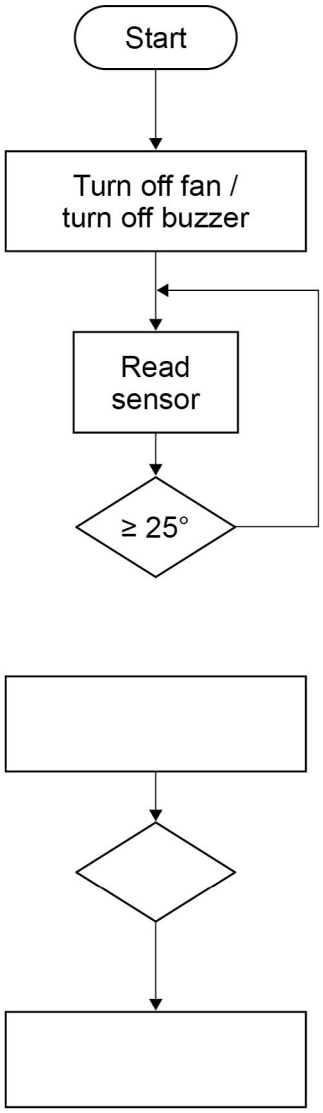

0 9 . 4 The flowchart uses the symbol ≥

What is the meaning of this symbol?

[1 mark]

Do not write outside the box

0 9 . 5 Give **two** reasons why a program might need to be modified.

[2 marks]

Reason 1 _____

_____

Reason 2 _____

_____

13

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1 0 . 1 Discuss the advantages and disadvantages of engineered lifespans for the manufacturer and consumer. Include at least **one** example in your answer.

[8 marks]

Question 10 continues on the next page

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1 0 . 2 Bicycle chains need to be maintained at regular intervals.

Give **two** examples of how a bicycle chain would be maintained.

[2 marks]

Example 1 _____

_____

Example 2 _____

_____

1 0 . 3 Explain why it is important to regularly maintain components like a bicycle chain.

[2 marks]

_____

_____

_____

_____

1 0 . 4 Statistical data is used to know how frequently components like bicycle chains need to be replaced.

Table 3

Bicycle Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Kilometres at failure	2200	3500	3700	2900	3100	2800	3200	3800

Use **Table 3** to calculate the mean distance at failure.

Show your working.

[2 marks]

_____

_____

_____

_____

Answer _____

Do not write outside the box

1 0 . 5 Give **two** factors that would make you change the bicycle chain.

[2 marks]

Factor 1 _____

_____

Factor 2 _____

_____

16

Turn over for the next question

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1 1 . 1 Quality control is an essential part of producing engineered products.

Give **one** example of a quality control check that could be applied after the manufacturing process.

[1 mark]

1 1 . 2 Explain why it is necessary to work to size tolerances when manufacturing products.

[2 marks]

1 1 . 3 Identify the tools in **Figure 11** and explain how to use **one** of them.

[4 marks]

Figure 11

Tool 1

Tool 2

Tool 1 _____

Tool 2 _____

My chosen tool is _____

How it is used _____

7

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1 2 . 1 Biomass is one method of energy production.

Name **one other** method of renewable energy production and **one** non-renewable method.

[2 marks]

Renewable _____

_____

Non-renewable _____

_____

1 2 . 2 Compare and evaluate the use of biomass with other energy production methods.

[8 marks]

END OF QUESTIONS

10

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