

Design and Technology
COMPONENT 1: Systems

Total Marks

Time: 1 hour 45 minutes

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Calculator, ruler, writing and drawing equipment, protractor, compass

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – there may be more space than you need.

Calculators may be used.

Any diagrams may NOT be accurately drawn, unless otherwise indicated.

You must show all your working out with your answer clearly identified at the end of your solution.

INFORMATION

The total mark for this paper is 100.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

There may be spare copies of some diagrams.

ADVICE

Read each question carefully before you start to answer it.

Try to answer every question.

Check your answers if you have time at the end.

SECTION A

Core

Answer ALL questions. Write your answers in the spaces provided.

- 1 (a) The materials that products are made from are chosen because of their properties.**

Look at FIGURE 1 for Question 1(a) in the Diagram Booklet. It shows a table of products.

For each of the products shown, give a property of the material it is made from that makes the material suitable for the product.

The first one has been done for you.

(continued on the next page)

1 continued.

(b) Explain ONE disadvantage of using urea formaldehyde for the 3-pin plug. (2 marks)

The pins of the 3-pin plug are made from brass.

**Brass is an alloy of copper and zinc in the ratio of 13:7
(13 parts copper to 7 parts zinc).**

(continued on the next page)

Turn over

1 continued.

- (c) Calculate how much copper is required to make 50 kg of brass.
(2 marks)**

Answer _____ kg

(Total for Question 1 = 8 marks)

Turn over

2 Look at FIGURE 2 for Question 2 in the Diagram Booklet. It shows a wall mounted book holder manufactured from mahogany.

**(a) Name ONE other appropriate hardwood that could be used to make the wall mounted book holder.
(1 mark)**

**(b) Explain ONE working property of mahogany that makes it an appropriate choice of material for the wall mounted book holder.
(2 marks)**

(continued on the next page)

Turn over

2 continued.

Each wall mounted book holder is made as a one-off.

**(c) Explain ONE advantage for the manufacturer of making each wall mounted book holder as a one-off.
(2 marks)**

2 continued.

Look at FIGURE 3 for Question 2(d) in the Diagram Booklet. It shows the sizes of two pieces of mahogany used to make the wall mounted book holder.

The mahogany has a cross sectional area of 5 cm^2

(continued on the next page)

2 continued.

- (d) Calculate the cost of the mahogany required to make one wall mounted book holder if the mahogany costs £1,200 m³.
(4 marks)**

Cost £ _____

(Total for Question 2 = 9 marks)

Turn over

3 Look at FIGURE 4 for Question 3 in the Diagram Booklet. It shows an electrically powered hand drill and the circuit symbol for an electrical component.

**(a) Name the type of electrical component from the circuit symbol shown in Figure 4.
(1 mark)**

The electrically powered hand drill is being redesigned. The manufacturer is considering using a bevel gear inside.

(continued on the next page)

3 continued.

- (b) Explain ONE reason for using a bevel gear inside the electrically powered hand drill.
(2 marks)**

- (c) The electrically powered hand drill also has a compound gear train inside.**

Look at FIGURE 5 for Question 3(c) in the Diagram Booklet. It shows a schematic diagram of the compound gear train.

(continued on the next page)

Turn over

3 continued.

**Calculate the revolutions per minute (RPM) of the driven gear if the driver gear rotates at 400 RPM.
(2 marks)**

Driven gear _____ RPM

(continued on the next page)

Turn over

3 continued.

**(d) Explain ONE benefit of using a battery for the electrically powered hand drill.
(2 marks)**

(continued on the next page)

3 continued.

The manufacturer of the electrically powered hand drill is considering using carbon fibre for the main body.

**(e) Explain TWO benefits of using carbon fibre for the main body of the electrically powered hand drill.
(4 marks)**

1 _____

(continued on the next page)

3 continued.

2 _____

(Total for Question 3 = 11 marks)

4 A not-for-profit organisation has developed some agro-textiles that can be used by farmers.

**(a) Explain TWO ways that agro-textiles can be used by farmers.
(4 marks)**

1 _____

(continued on the next page)

4 continued.

2 _____

(b) A farmer requires 420 m^2 of agro-textile to cover their field.

The agro-textile is available in rolls 50 m long measuring 1·2 m wide.

(continued on the next page)

4 continued.

**Calculate the number of rolls of agro-textile the farmer needs to cover their field.
(2 marks)**

Number of rolls _____

(continued on the next page)

Turn over

4 continued.

**(c) Discuss how fair trade products have been used to support farmers and societies in developing countries.
(6 marks)**

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Turn over

4 continued.

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(Total for Question 4 = 12 marks)

TOTAL FOR SECTION A = 40 MARKS

SECTION B

Systems

Answer ALL questions. Write your answers in the spaces provided.

5 Look at FIGURE 6 for Question 5 in the Diagram Booklet. It shows a design solution for a bird box together with some additional information.

(a) The bird box provides a nesting place for birds and needs to be improved to include the following specification points.

The bird box must:

- **hold the camera inside so it can be easily removed to replace the batteries and allows access to a digital photographic storage system**

(continued on the next page)

Turn over

5 continued.

- **take a photograph of the bird with the camera when entry is detected through the hole**
- **be able to be hung up in a tree and easily moved to another tree.**

In the Diagram Booklet, use notes and sketches, on the outline, to show how the bird box could be modified to include these three specification points.

**You will be marked on how you apply your understanding of design and technology, not your graphical skills.
(6 marks)**

(continued on the next page)

5 continued.

(b) Look at FIGURE 7 for Question 5(b) in the Diagram Booklet. It shows a money box in the shape of a tea cup that plays a tune every time a coin is dropped in the slot.

**Explain TWO ways that the money box meets, or fails to meet, the criteria of providing a method to encourage young children to save money.
(4 marks)**

1 _____

5 continued.

2 _____

(Total for Question 5 = 10 marks)

- 6 Look at FIGURE 8 for Question 6(a) in the Diagram Booklet. It shows an exploded view of an alarm system for a building.**

The circuit for the alarm system contains some standard components, including resistors and a light-emitting diode (LED).

- (a) Explain TWO reasons why the manufacturer would use Ohm's law when designing the circuit for the alarm system.
(4 marks)**

1 _____

6 continued.

2 _____

(continued on the next page)

6 continued.

(b) Look at FIGURE 9 for Question 6(b) in the Diagram Booklet. It shows the internal fixing case for the alarm system that has been vacuum formed from high impact polystyrene (HIPS).

On this page and on page 32, use notes and sketches to show how the internal fixing case would be manufactured using the vacuum forming process.

**You will be marked on how you apply your understanding of design and technology, not your graphical skills.
(4 marks)**

6 continued.

(continued on the next page)

Turn over

6 continued.

(c) The front panel of the alarm system has been anodised.

**Explain ONE reason why an anodised finish has been applied to the front panel.
(2 marks)**

(continued on the next page)

Turn over

6 continued.

(d) Give TWO different methods of cable management that can be used inside the alarm system.

**For each method, explain ONE advantage of using the method of cable management inside the alarm system.
(6 marks)**

Method 1

Explanation

(continued on the next page)

Turn over

6 continued.

Method 2

Explanation

(Total for Question 6 = 16 marks)

- 7 Look at FIGURE 10 for Question 7 in the Diagram Booklet. It shows a desk lamp powered by a USB lead connected to a laptop.**

The USB lead has copper wires inside.

The main body is cut out from a single piece of white acrylic and the two side pieces are bent outwards by placing in the top part to form the curves.

- (a) State the type of force the top part is subjected to from the two side pieces of the main body.
(1 mark)**
-
-

- (b) Explain TWO working properties of copper that make it an ideal material for the wires inside the USB lead.
(4 marks)**

(continued on the next page)

Turn over

7 continued.

1 _____

2 _____

(continued on the next page)

Turn over

7 continued.

Look at FIGURE 11 for Question 7(c) in the Diagram Booklet. It shows a dimensioned drawing of the main body of the desk lamp before the sides are bent.

The main body is manufactured from a single piece of white acrylic.

(c) On the next two pages, calculate the volume of waste material produced when making the main body.

Give your answer to the nearest whole cm^3 .

**Use $\pi = 3.142$
(5 marks)**

(continued on the next page)

7 continued.

7 continued.

Answer _____ cm³

(continued on the next page)

Turn over

7 continued.

The main body of the desk lamp could be fabricated from separate pieces of white acrylic rather than from a single piece.

**(d) Explain TWO reasons for fabricating the main body of the desk lamp from separate pieces of white acrylic rather than manufacturing it from a single piece.
(6 marks)**

1 _____

(continued on the next page)

Turn over

7 continued.

2

(Total for Question 7 = 16 marks)

Turn over

- 8 Look at FIGURE 12 for Question 8 in the Diagram Booklet. It shows a speed sensing road sign manufactured from aluminium.**

The sign displays the speed limit for the area and the speed of a car as it approaches the sign.

The speed of a vehicle is displayed on the road sign using light-emitting diodes (LEDs).

- (a) Explain ONE benefit of using LEDs to display the number under the words 'YOUR SPEED'.
(2 marks)**

(continued on the next page)

Turn over

8 continued.

The LEDs are subjected to quality control checks during their manufacture.

**(b) Explain ONE advantage of carrying out a quality control check on the LEDs during manufacture.
(3 marks)**

(continued on the next page)

Turn over

8 continued.

The speed sensing road signs use photo etched circuit boards for the electronic circuitry.

**(c) Explain TWO reasons for etching the circuit boards for the road signs.
(4 marks)**

1 _____

2 _____

(continued on the next page)

Turn over

8 continued.

- (d) The speed sensing road sign is manufactured from aluminium and the words ‘SPEED LIMIT’ and ‘YOUR SPEED’ are screen printed.**

Look at FIGURE 13 for Question 8(d) in the Diagram Booklet. It shows some additional information about the speed sensing road sign.

Analyse the information in the Figure 13.

(continued on the next page)

8 continued.

Evaluate the speed sensing road sign with reference to social and availability factors including:

- **use for different social groups**
- **use of stock materials**
- **use of specialist materials.**

(9 marks)

(continued on the next page)

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8 continued.

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(Total for Question 8 = 18 marks)

TOTAL FOR SECTION B = 60 MARKS

TOTAL FOR PAPER = 100 MARKS

END OF PAPER