

Design and Technology
COMPONENT 1: Papers and Boards

Total Marks

Tuesday 18 June 2024 – Morning

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, pair of compasses

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.

Turn over

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.
(4 marks)**

(continued on the next page)

Turn over

1 continued.

- (b) (i) The frying pan is made from cast iron. Cast iron is hard, therefore it does not scratch easily.**

**Explain ONE OTHER advantage of using cast iron for the frying pan.
(2 marks)**

(continued on the next page)

Turn over

1(b) continued.

(ii) Cast iron contains 2% carbon.

**The cast iron frying pan
weighs 3 kg**

**Calculate how many grams
of carbon are in the cast iron
frying pan.
(2 marks)**

Answer space continues on the next page.

1(b)(ii) continued.

Answer _____ grams

(Total for Question 1 = 8 marks)

Turn over

2 Look at Figure 2 for Question 2 in the Diagram Booklet. It shows a wooden sheep that is being threaded with a yarn.

**(a) Name ONE specific animal fibre that can be used to make the yarn being threaded in Figure 2.
(1 mark)**

(continued on the next page)

2 continued.

The wood that is used to manufacture the sheep is delivered to the manufacturer using vehicles powered by biofuels.

**(b) Explain ONE advantage of using biofuels to power the delivery vehicles.
(2 marks)**

(continued on the next page)

Turn over

2 continued.

- (c) Explain ONE advantage of using computer-aided design (CAD) when producing the design ideas for the wooden sheep.
(2 marks)**

(continued on the next page)

2 continued.

A new animal shape needs to be designed.

The designer has collected some data about the popularity of specific animals amongst young children.

Look at Figure 3 for Question 2(d)(i) in the Diagram Booklet. It is a table of data showing the popularity of specific animals amongst young children.

**(d) (i) Complete Figure 3 by calculating the TWO missing values.
(2 marks)**

Answer space continues on the next page.

Space for working

Turn over

2(d)(i) continued.

Number of votes for Rabbit _____

Number of votes for Mouse _____

(continued on the next page)

Turn over

2(d) continued.

Look at Figure 4 for Question 2(d)(ii) in the Diagram Booklet. It is a partly completed bar chart that shows the percentage of votes received for the Cat and the Dog.

- (ii) Complete the bar chart shown in Figure 4 to show the percentage of votes received for the Rabbit and the Mouse.
(2 marks)**

(Total for Question 2 = 9 marks)

3 Look at Figure 5 for Question 3 in the Diagram Booklet. It shows a pulley and pulley belt, a motor, and the cross section of the pulley belt used in a model boat drive system.

**(a) Name the type of pulley belt shown in the cross section in Figure 5.
(1 mark)**

(continued on the next page)

3 continued.

(b) Explain ONE reason for manufacturing the pulley from aluminium rather than mild steel. (2 marks)

(continued on the next page)

3 continued.

Look at Figure 6 for Question 3(c) in the Diagram Booklet. It shows the pulley system for the model boat drive system.

(c) The pulley system has a velocity ratio of 5:1

The input speed is 2000 revolutions per minute (rpm).

Calculate the output speed of the pulley system.

Use the formula below to calculate the answer.

$$\text{Velocity ratio} = \frac{\text{input speed}}{\text{output speed}}$$

**Give your answer in rpm.
(2 marks)**

Answer space continues on the next 2 pages.

Turn over

3(c) continued.

3(c) continued.

Answer _____ rpm

(continued on the next page)

3 continued.

Look at Figure 7 for Question 3(d) in the Diagram Booklet. It shows the motor for the model boat is powered by the solar cell.

The solar cell is 5 cm by 5 cm

- (d) Explain ONE disadvantage of using the solar cell to power the motor for the model boat.
(2 marks)**

(continued on the next page)

Turn over

3 continued.

Look at Figure 8 for Question 3(e) in the Diagram Booklet. It shows the frame for the model boat.

The model boat has been manufactured from balsa wood.

**(e) Explain TWO benefits of using balsa wood for the frame of the model boat.
(4 marks)**

Answer space continues on the next page.

1 _____

Turn over

3(e) continued.

2 _____

(Total for Question 3 = 11 marks)

- 4 (a) Explain TWO ways that conductive inks can be used in products.
(4 marks)

Answer space continues on the next page.

1 _____

4(a) continued.

2 _____

(continued on the next page)

4 continued.

(b) A small batch of conductive ink weighs 9 grams.

The ink contains 40% of hazardous material by weight.

**Calculate the weight of hazardous material present in the ink in grams.
(2 marks)**

Answer space continues on the next page.

4(b) continued.

Answer _____ grams

(continued on the next page)

4 continued.

- (c) Discuss how designers can minimise the environmental impact of materials when developing new and emerging technologies.
(6 marks)**

Answer space continues on the next 4 pages.

Turn over

4(c) continued.

Turn over

4(c) continued.

Turn over

4(c) continued.

Turn over

4(c) continued.

(Total for Question 4 = 12 marks)

TOTAL FOR SECTION A = 40 MARKS

Turn over

SECTION B

Papers and boards

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

- 5 Look at Figure 9 for Question 5 in the Diagram Booklet. It shows a design solution for a craft knife rack to hold three craft knives, together with some additional information.**
- (a) The craft knife rack holds three craft knives and needs to be improved to include the following specification points.**

(continued on the next page)

5(a) continued.

The craft knife rack must:

- **be able to hold an additional three craft knives and stop the craft knives from moving as the rack is carried around a workshop**
- **protect the user from potential cuts when carrying the rack and have a surface finish that is easy to clean**
- **be more stable when placed on a bench and be capable of being hung up on a wall.**

Use notes and sketches to show how the craft knife rack 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.

(continued on the next page)

Turn over

5(a) continued.

**Look at the outline diagram for
Question 5(a) in the Diagram Booklet.
Use the outline of the original design
solution to show your modifications.
(6 marks)**

(continued on the next page)

5 continued.

(b) Look at Figure 10 for Question 5(b) in the Diagram Booklet.

It shows a matching game made from cardboard.

Explain TWO ways that the matching game meets, or fails to meet, the criterion of providing a method to educate young children about healthy eating.

(4 marks)

Answer space continues on the next page.

1 _____

Turn over

5(b) continued.

2 _____

(Total for Question 5 = 10 marks)

- 6 Look at Figure 11 for Question 6 in the Diagram Booklet. It shows a battery-powered candle and a cardboard house.**

The candle sits in an insert inside the cardboard house.

The main body of the house has been manufactured from folding box board and the roof has been manufactured from foil-lined board.

The cardboard house has been finished with an embossed design.

(continued on the next page)

6 continued.

- (a) Explain TWO reasons for finishing the cardboard house with an embossed design.
(4 marks)**

Answer space continues on the next page.

1 _____

6(a) continued.

2 _____

(continued on the next page)

6 continued.

(b) Look at Figure 12 for Question 6(b) in the Diagram Booklet. It shows a dimensioned plan view drawing of a marked-out piece of folding box board that is ready to be made into the insert that will hold the battery-powered candle.

The folding box board has a thickness of 2 mm

Use notes and sketches, in the space on the next two pages, to show how the insert for the battery-powered candle would be produced using hand tools.

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

Answer space continues on the next 2 pages.

Turn over

6(b) continued.

6(b) continued.

(continued on the next page)

6 continued.

- (c) Explain ONE physical characteristic of folding box board that makes it an ideal material for the main body of the house.
(2 marks)**

(continued on the next page)

Turn over

6 continued.

Look at Figure 13 for Question 6(d) in the Diagram Booklet. It shows a dimensioned side view of the main body of the cardboard house.

(d) Give TWO different manufacturing methods that could be used to remove the waste material to form the roof shape as shown in Figure 13.

**Explain ONE reason for using each manufacturing method.
(6 marks)**

Answer space continues on the next 2 pages.

Turn over

6(d) continued.

Method 1

Explanation

6(d) continued.

Method 2

Explanation

(Total for Question 6 = 16 marks)

- 7 Look at Figure 14 for Question 7 in the Diagram Booklet. It shows a child's chair.**

The chair has been manufactured from corrugated cardboard.

Two layers of corrugated cardboard have been used to manufacture the curved back rest.

- (a) Name the specific technique that has been used to manufacture the curved back rest shown in Figure 14.
(1 mark)**

(continued on the next page)

7 continued.

- (b) Explain TWO working properties of corrugated cardboard that make it an ideal material for the curved back rest.
(4 marks)**

Answer space continues on the next page.

1 _____

Turn over

7(b) continued.

2 _____

(continued on the next page)

7 continued.

Look at Figure 15 for Question 7(c) in the Diagram Booklet. It shows a dimensioned drawing of a curved front panel before it has been attached to the seat.

Circumference of a circle = πD

Use $\pi = 3.142$

(c) Calculate how many of the curved front panels shown in Figure 15 can be cut from a large flat sheet of corrugated cardboard that measures $244\text{ cm} \times 122\text{ cm}$

**Ignore the width of any cuts.
(5 marks)**

Answer space continues on the next page.

Turn over

7(c) continued.

Answer _____

(continued on the next page)

Turn over

7 continued.

(d) Look at Figure 16 for Question 7(d) in the Diagram Booklet. It shows a paper engineered joint that has been used to join the seat to the curved back rest.

**Explain TWO advantages of using a paper engineered joint to join the seat to the curved back rest.
(6 marks)**

Answer space continues on the next 2 pages.

Turn over

7(d) continued.

1 _____

7(d) continued.

2 _____

(Total for Question 7 = 16 marks)

- 8 Look at Figure 17 for Question 8 in the Diagram Booklet. It shows a drawing of a self-assembly solid white board box.**

Manufacturing self-assembly boxes from solid white board is cost effective.

- (a) Explain ONE OTHER benefit of manufacturing the self-assembly boxes from solid white board.
(2 marks)**

(continued on the next page)

Turn over

8 continued.

**(b) Explain ONE advantage of using stock weight material for the self-assembly boxes.
(3 marks)**

(continued on the next page)

8 continued.

- (c) Explain TWO ways that waste can be reduced during the manufacture of the self-assembly boxes.
(4 marks)**

Answer space continues on the next page.

1 _____

Turn over

8(c) continued.

2 _____

(continued on the next page)

8 continued.

- (d) The self-assembly boxes are manufactured in the United Kingdom and sold around the world.**

Look at Figure 18 for Question 8(d) in the Diagram Booklet. It shows some additional information about the self-assembly boxes.

Analyse the information in Figure 18.

Evaluate the self-assembly boxes with reference to cost factors including:

- quality of material**
- manufacturing processes**
- decorative techniques.**

(9 marks)

Answer space continues on the next 4 pages.

Turn over

8(d) continued.

Turn over

8(d) continued.

Turn over

8(d) continued.

Turn over

8(d) continued.

[illegible]

(Total for Question 8 = 18 marks)

TOTAL FOR SECTION B = 60 MARKS

TOTAL FOR PAPER = 100 MARKS

END OF PAPER