

Design and Technology

COMPONENT 1: Papers and Boards

Total Marks
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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.**

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## **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)**

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**(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)**

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**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)**

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**(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)**

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**(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)**

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**(continued on the next page)**

**Turn over**

**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)**

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**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)**

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**(continued on the next page)**

**3 continued.**

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

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**(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.**

**Turn over**

**3(c) continued.**

**Answer \_\_\_\_\_ rpm**

**(continued on the next page)**

**Turn over**

**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)**

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**(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.**

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**Turn over**

**3(e) continued.**

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**(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.

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4(a) continued.

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(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.**

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**Turn over**

4(c) continued.

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4(c) continued.

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4(c) continued.

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**4(c) continued.**

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**(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.**

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**Turn over**

**5(b) continued.**

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**(Total for Question 5 = 10 marks)**

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- 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.**

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**Turn over**

6(a) continued.

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(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)**

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**(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

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Explanation

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**6(d) continued.**

**Method 2**

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**Explanation**

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**(Total for Question 6 = 16 marks)**

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- 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)**

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**(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.**

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**Turn over**

7(b) continued.

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(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 =  $\pi D$**

**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 cm × 122 cm**

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

**Answer space continues on the next page.**

**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.

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**7(d) continued.**

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**(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)**

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**(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)**

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**(continued on the next page)**

**Turn over**

**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.**

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**Turn over**



8(c) continued.

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(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.**

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**Turn over**

8(d) continued.

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8(d) continued.

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**8(d) continued.**

[illegible]

**(Total for Question 8 = 18 marks)**

**TOTAL FOR SECTION B = 60 MARKS**

**TOTAL FOR PAPER = 100 MARKS**

# END OF PAPER