

**Design and Technology**  
**(Product Design)**  
**Advanced**  
**COMPONENT 1**

Total Marks
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**Time: 2 hours 30 minutes**

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

<b>Surname</b>					
<b>Other names</b>					
<b>Centre Number</b>					
<b>Candidate Number</b>					

## **YOU MUST HAVE**

**A calculator and a ruler**

## **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.**

**For questions requiring mathematics, 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 120.**

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

**1 Look at Figure 1 for Question 1 in the Diagram Booklet. It shows a sink made from stainless steel.**

**(a) Stainless steel is an alloy of iron, carbon and other metals.**

**Name TWO other metals that can be alloyed with iron and carbon to make stainless steel.**

**(2 marks)**

**1** \_\_\_\_\_

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**2** \_\_\_\_\_

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**1 continued.**

- (b) Stainless steel has been used because the sink needs to be strong and durable.**

**Explain TWO further working properties of stainless steel that make it a suitable material for the sink when used for food preparation and dishwashing.  
(4 marks)**

**1** \_\_\_\_\_

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**1 continued.**

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**1 continued.**

**(c) Look at Figure 2 for Question 1(c) in the Diagram Booklet. It shows a sink plug.**

**The sink plug is made out of rubber.**

**Explain ONE reason why rubber is a suitable material for the sink plug.  
(3 marks)**

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**(Total for Question 1 = 9 marks)**

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**2 Look at Figure 3 for Question 2 in the Diagram Booklet. It shows a drawing of a component that is to be manufactured for use in a consumer product. The component is to be milled from a solid block of aluminium.**

**(a) State TWO other methods for producing the component from aluminium.  
(2 marks)**

**1** \_\_\_\_\_

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**2** \_\_\_\_\_

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**2 continued.**

- (b) The original solid block of aluminium was 135 mm × 30 mm × 45 mm and had a mass of 492 g.**

**Calculate the mass of the finished milled component.**

**Give your answer in grammes (g) to 1 decimal place.**

**Show all of your workings.  
(5 marks)**

**(continued on the next page)**

**Turn over**

2 continued.

Answer \_\_\_\_\_ g

(Total for Question 2 = 7 marks)

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- 3 Look at Figure 4 for Question 3 in the Diagram Booklet. It shows a fizzy drinks bottle manufactured from polyethylene terephthalate (PET).**

**Polyethylene terephthalate (PET) can be blow moulded.**

- (a) Explain ONE other property of polyethylene terephthalate (PET) that makes it suitable for the fizzy drinks bottle.  
(2 marks)**

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**3 continued.**

- (b) Describe, using labelled sketches, the blow moulding process used to produce the bottle.  
(4 marks)**

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**3 continued.**

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**3 continued.**

- (c) Explain TWO reasons why blow moulding has been used for the production of the bottle.  
(6 marks)**

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**3 continued.**

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**(Total for Question 3 = 12 marks)**

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- 4 A manufacturer of consumer goods is considering replacing some of its products with new and repurposed designs. This requires a lot of planning, preparation and evaluation.

(a) Critical path analysis is a planning method.

Give THREE features of critical path analysis.  
(3 marks)

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**4 continued.**

- (b) Manufacturers need to undertake financial forecasts which include the preparation of budgets.**

**Outline considerations that need to be taken into account when preparing budgets.**

**(6 marks)**

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**4 continued.**

**(c) A trademark allows a manufacturer to provide easy identification of their genuine products.**

**Give TWO forms a trademark may take to identify the genuine product.**

**(2 marks)**

**1** \_\_\_\_\_

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**2** \_\_\_\_\_

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**4 continued.**

- (d) Discuss cost, sales, profit and market implications to the manufacturer during the various stages of a product's life cycle.  
(9 marks)**

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**(Total for Question 4 = 20 marks)**

- 5 A manufacturer has been commissioned to produce a solid sphere with a volume of 10 litres. The volume of a sphere can be calculated using the following formula:

$$V = (4\pi r^3)/3$$

- (a) Calculate the radius of the sphere.

$$1 \text{ litre} = 1000 \text{ cm}^3$$

Give your answer in cm to 2 decimal places.  
(5 marks)

Answer \_\_\_\_\_ cm

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**5 continued.**

- (b) The sphere is to be made from aluminium which has a density of 2·7 tonnes per m<sup>3</sup>.**

**Calculate the mass of the 10 litre sphere in kilogrammes (kg).**

**1 tonne = 1000 kilogrammes (kg)**

**Use mass (M) = volume (V) × density (d)  
(3 marks)**

**Answer \_\_\_\_\_ kg**

**(Total for Question 5 = 8 marks)**

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**Turn over**

**6 Look at Figure 5 for Question 6 in the Diagram Booklet. It shows a wood joint that is to be used on a single piece of furniture. The joint will be positioned and marked out using a pencil and other marking out tools.**

**(a) Name TWO other marking out tools used to position and mark out the joint accurately and efficiently.  
(2 marks)**

**1** \_\_\_\_\_

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**2** \_\_\_\_\_

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**6 continued.**

- (b) The manufacturer has received an order for 50 identical pieces of furniture.**

**Explain TWO reasons why batch production would be used for the manufacturing of the furniture.**

**(6 marks)**

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- (c) The furniture is manufactured and finished in a small workshop environment.**

**Discuss the significance of health and safety laws and regulations to the manufacturer of the furniture.**

**(6 marks)**

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**6 continued.**

**Each piece of furniture will be sold with separate padded cushions that have textile covers.**

**(d) Name TWO natural fibre textiles that could be used for the cushion covers.**

**(2 marks)**

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**2** \_\_\_\_\_

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**6 continued.**

- (e) The textile fabric is in rolls 500m long by 1·3m wide. Each cushion cover requires a single piece of fabric 0·45m by 0·85m.**

**Calculate the maximum number of cushion covers that can be manufactured from one roll.  
(3 marks)**

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

**(Total for Question 6 = 19 marks)**

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**Turn over**

- 7 Look at Figure 6 for Question 7 in the Diagram Booklet. It shows a component drawn in 3rd angle orthographic projection (not to scale).**

**Designers use a range of different drawing techniques to convey their design ideas.**

**Look at the isometric grid for Question 7 in the Diagram Booklet.**

**Draw an accurate isometric projection of the component.**

**Use the isometric grid in the Diagram Booklet, starting with line A–B as your front corner.**

**Each segment of the grid equals 10mm.**

**Dimensioning of the isometric projection is NOT required.  
(6 marks)**

**(Total for Question 7 = 6 marks)**

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- 8 Look at Figures 7 and 8 for Question 8 in the Diagram Booklet. They show external and internal views of The Red House which was the vision of William Morris and became the centre of his Arts and Crafts movement.**

**Discuss the style and design philosophy of the Arts and Crafts movement and how it may have influenced the house design shown in Figures 7 and 8.**

**(9 marks)**

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**(Total for Question 8 = 9 marks)**

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- 9 Look at Figure 9 for Question 9 in the Diagram Booklet. It shows a modern smart watch that offers a wide range of functions such as fitness tracking, health monitoring, calendars and music.**

**Discuss how modern technology and miniaturisation of components have enabled the development of smart watches.**

**(9 marks)**

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**(Total for Question 9 = 9 marks)**

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- 10 Photo-chromic lenses are becoming a popular choice for people who wear glasses to correct their eyesight.**

**Explain THREE advantages to the user of purchasing glasses with photo-chromic lenses rather than standard lenses.**

**(9 marks)**

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**10 continued.**

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**(Total for Question 10 = 9 marks)**

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- 11 Look at Figure 10 for Question 11 in the Diagram Booklet. It shows a reclining armchair and footstool.**

**The chair has a steel frame and reclining mechanism, laminated beech base and legs, and flame resistant foam cushions that are covered in leather.**

**Evaluate the performance of the reclining armchair and footstool with reference to aesthetics and user requirements.**

**(12 marks)**

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**11 continued.**

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**11 continued.**

[illegible]

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**11 continued.**

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**11 continued.**

[illegible]

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**11 continued.**

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**(Total for Question 11 = 12 marks)**

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**TOTAL FOR PAPER = 120 MARKS**  
**END OF PAPER**