

**Modified Enlarged 24pt**  
**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Thursday 18 November 2021 – Afternoon**

**GCSE (9–1) Design and Technology**

**J310/01 Principles of Design and  
Technology**

**Time allowed: 2 hours  
plus your additional time allowance**

**YOU MUST HAVE:**  
**the Insert (with this document)**

**YOU CAN USE:**  
**a scientific calculator**  
**a ruler (cm/mm)**  
**geometrical instruments**

**Please write clearly in black ink.**

**Centre number**

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**Candidate number**

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**First name(s)** \_\_\_\_\_

**Last name** \_\_\_\_\_

**READ INSTRUCTIONS OVERLEAF**



# **INSTRUCTIONS**

**Use black ink. You can use an HB pencil, but only for graphs and diagrams.**

**Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.**

**Answer ALL the questions.**

**Use the Insert to answer the questions in Section B.**

**Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.**

# **INFORMATION**

**The total mark for this paper is 100.**

**The marks for each question are shown in brackets [ ].**

**Quality of extended response will be assessed in questions marked with an asterisk (\*).**

## **ADVICE**

**Read each question carefully before you start your answer.**

## SECTION A

**Answer ALL the questions.**

**1 FIG. 1 opposite shows images of a box of chocolates.**

**(a) The box is made from cardboard.  
Give THREE reasons why cardboard  
is a suitable material for the  
chocolate box.**

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

\_\_\_\_\_

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

\_\_\_\_\_

**3** \_\_\_\_\_

\_\_\_\_\_

**[3]**

**FIG. 1**



**box made  
from cardboard**

**tray made  
from a  
thermo  
polymer**



**chocolate wrapped in  
aluminium foil**

**(b) The tray in the chocolate box is made from a thermo polymer.**

**Name ONE thermo polymer.**

\_\_\_\_\_ **[1]**

**(c) Some of the chocolates are wrapped in aluminium foil, a non-ferrous metal.**

**Name ONE other non-ferrous metal.**

\_\_\_\_\_ **[1]**

**(d) Explain THREE ways the packaging of the chocolates shown in FIG. 1 could be designed or manufactured in a more sustainable way.**

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

**3** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**[6]**

- (e) Designers are increasing the use of biopolymers in product packaging.**

**What is a biopolymer?**

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**[1]**

- (f)\* Many designers and manufacturers are using biopolymers and sustainable materials in the design of packaging.**

**Discuss the reasons why biopolymers and sustainable materials are used in packaging.**

**Use examples to support your answer. [8]**

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[illegible]

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**2 FIG. 2 opposite shows a traditional style deck chair.**

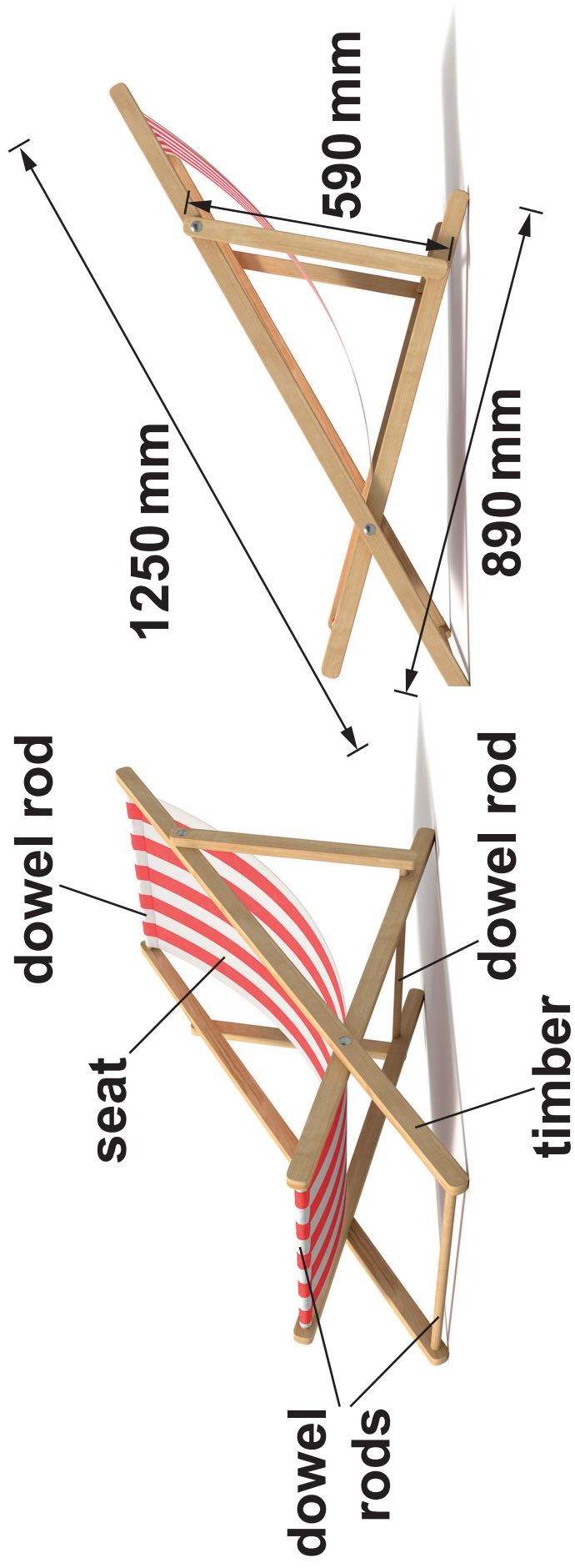
- (a) (i) The deck chair seat is made from a rectangular piece of woven fabric measuring 500 mm wide and 1370 mm long.**

**Calculate the area of fabric needed to make ONE deck chair.**

**State the unit for your answer.**

**Area of fabric \_\_\_\_\_ Unit \_\_\_\_\_[2]**

**FIG. 2**



- (ii) The woven fabric is manufactured in 1 m × 50 m rolls.**

**Calculate how many deck chair seats can be cut from ONE roll of fabric.**

**Number of deck chair seats \_\_\_\_\_ [3]**

- (iii) The deck chair seat is made from a woven fabric, which makes it strong.**

**Describe how the construction of a woven fabric makes it strong.**

\_\_\_\_\_  
\_\_\_\_\_ **[1]**

**(b) The deck chair frame in FIG. 2 is made from six pieces of timber (excluding dowel rods).**

**The timber is supplied in standard lengths of 1800 mm.**

**The standard lengths of timber CANNOT be joined.**

**Calculate the MINIMUM number of standard lengths of timber needed to make the frames (excluding dowel rods) for a batch of 50 deck chairs.**

**Number of standard lengths \_\_\_\_\_ [4]**

**(c) Hex-headed bolts are used in the manufacture of the deck chair.**

**The bolts are supplied in packs of 10.**

**One pack of 10 bolts cost £19.99.**

**(i) Each deck chair uses FOUR bolts.**

**Calculate the total cost of the bolts needed to make 50 deck chairs.**

**Total cost £\_\_\_\_\_ [2]**



- (ii) The supplier of the bolts gives a discount if the manufacturer buys the bolts in bulk.**

**The manufacturer purchases 400 packs of bolts at a cost of £5997.**

**Calculate the percentage discount the supplier has given.**

**Discount \_\_\_\_\_ % [3]**

**(d) The table below shows deck chair sales per season in the year 2020.**

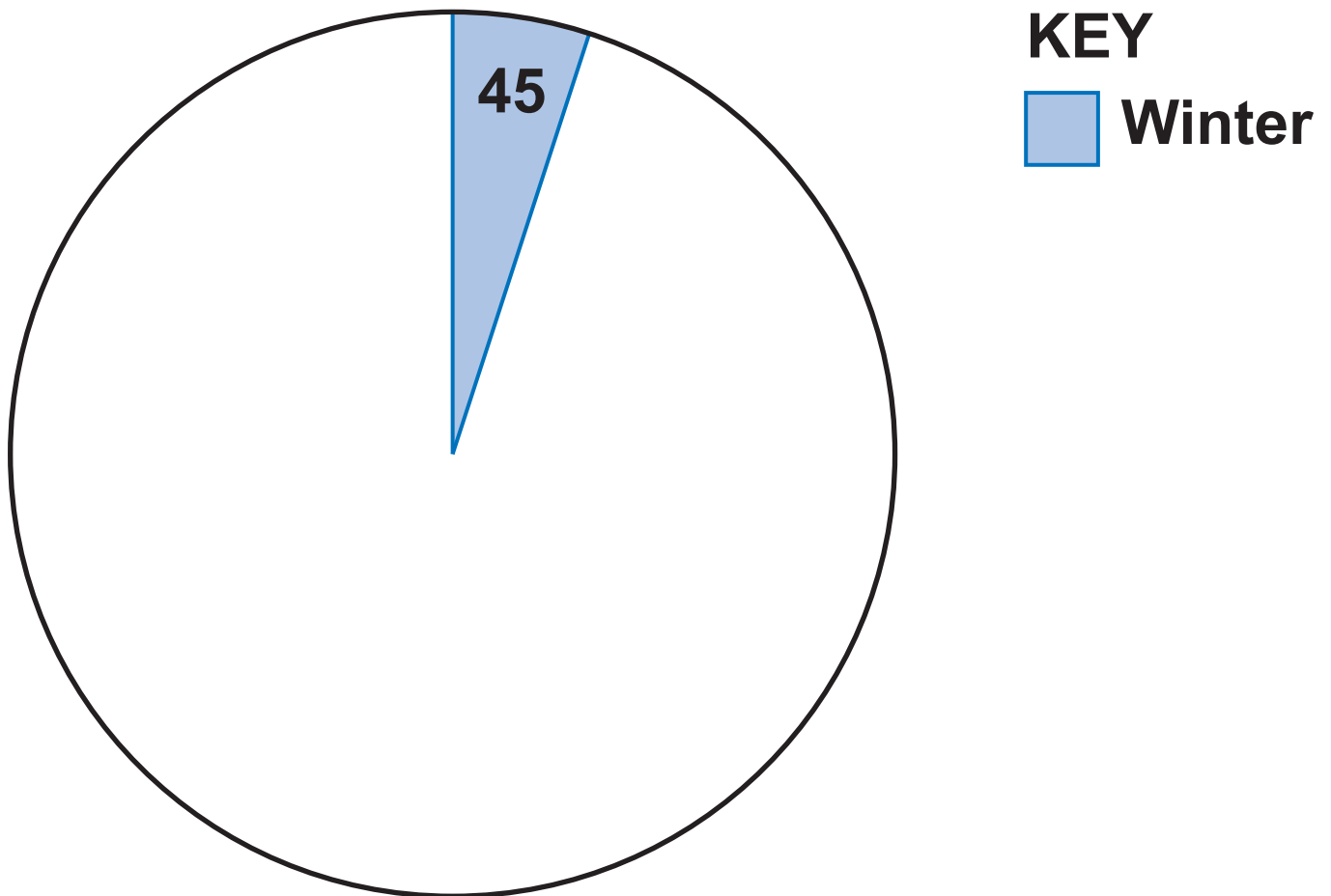
<b>Season</b>	<b>Number of sales per season</b>
<b>Winter</b>	<b>45</b>
<b>Spring</b>	<b>315</b>
<b>Summer</b>	<b>450</b>
<b>Autumn</b>	<b>90</b>
<b>Total sales in 2020</b>	<b>900</b>

**Complete the pie chart to show the total deck chair sales in 2020 for each season.**

**Winter has been done for you.**

**Add labels or a key. [3]**

**Total sales per season in 2020**



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**3 FIG. 3a shows a children's night light.**

**The night light is hollow and moulded from a polymer material in a shell form.**

**The night light turns on automatically when it gets dark as shown in FIG. 3b.**

**FIG. 3a**



**FIG. 3b**



**FIG. 4 opposite shows the instructions for the night light.**

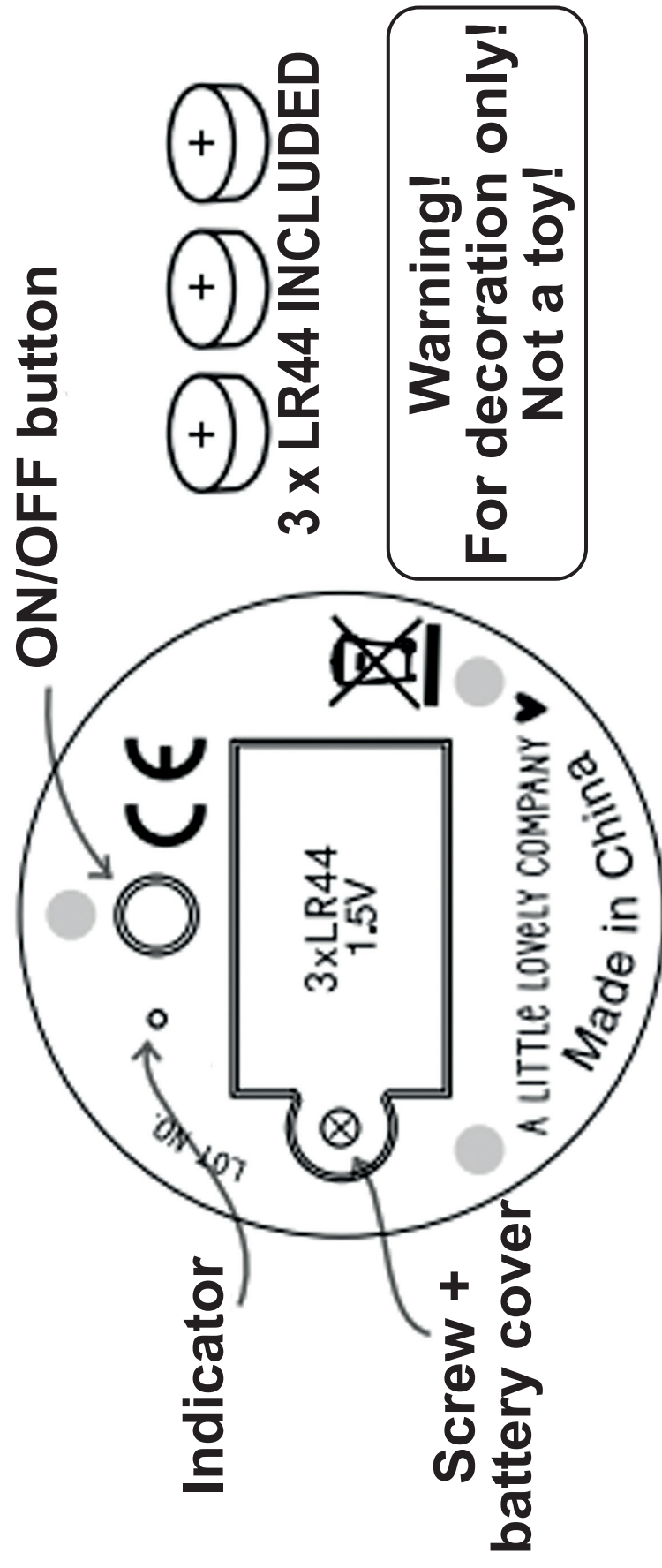
**(a) (i) Complete the missing information in the table below for the children's night light. [4]**

<b>Function</b>	<b>Input or output</b>	<b>Electronic component</b>
<b>Detects light and produces a signal</b>		
<b>Produces light</b>	<b>Output</b>	
	<b>Input</b>	<b>Switch</b>

**FIG. 4**

## **HOW TO USE**

**Batteries located under the light.**



- (ii) The night light has been designed to be powered by batteries.**

**Give ONE advantage of using batteries instead of mains electricity.**

\_\_\_\_\_ **[1]**

- (iii) Describe ONE way the designer has made sure the night light is safe for use by children.**

\_\_\_\_\_  
\_\_\_\_\_ **[1]**



**(b) Renewable energy can be used to create electricity.**

**(i) Complete the missing information in the table below. [4]**

<b>Description of how renewable energy is used to create electricity</b>	<b>Type of renewable energy</b>
<b>A dam is used to trap water; when water is released it turns turbines which turn generators</b>	
	<b>Wind power</b>
<b>Photovoltaic cells convert light to electricity</b>	
<b>Fuel (wood, organic material, sugar cane etc) is burnt to generate heat which creates steam and turns turbines which turn generators</b>	

**(ii) Give TWO reasons why fossil fuels are considered bad for the environment.**

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

\_\_\_\_\_

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

\_\_\_\_\_

**[2]**

- (c) The wall stickers shown below contain a phosphorescent pigment that glows in the dark.**



- (i) Phosphorescent pigment is a smart material.**

**Identify ONE other smart material.**

\_\_\_\_\_ **[1]**

**(ii) Describe TWO other ways designers are using smart materials in products to improve their functionality or benefit the users.**

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**[4]**

## **SECTION B**

**Answer ALL the questions.**

**For ALL questions in Section B you MUST refer to the INSERT which contains images and information about products that are used in a kitchen.**

**4 Refer to PAGE 14 of the Insert.**

**(a) IMAGE A shows a garlic crusher.  
The user places the garlic bulb  
into the chamber and squeezes the  
handles to crush the garlic.**

**(i) Identify the type of mechanism  
used in the garlic crusher.**

**\_\_\_\_\_ [1]**

**(ii) Explain why mechanisms are commonly used in kitchen gadgets.**

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**[2]**

**(b) IMAGE B shows a saucepan. The body of the saucepan is made from a metal and the handle is made from a thermosetting polymer.**

**Explain ONE reason why a thermosetting polymer is suitable for the saucepan handle.**

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**[2]**

**(c) IMAGE C shows a wooden chopping board and utensils.**

**(i) Name ONE hardwood.**

\_\_\_\_\_ **[1]**

**(ii) Give TWO reasons why the designer may have chosen to make the chopping board and utensils from wood.**

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

\_\_\_\_\_

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

\_\_\_\_\_

**[2]**

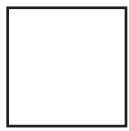
**You need to answer questions 5 and 6 in relation to ONE of the products listed below covering an area you have studied in depth.**

**Information about the products is contained in the INSERT.**

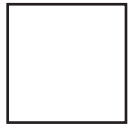
**Before you choose a product, read all parts of questions 5 and 6.**

**You MUST tick ONE box below to indicate your chosen product.**

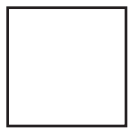




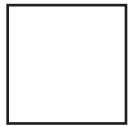
**PRODUCT 1: Recipe cards – (papers and boards)**



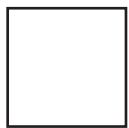
**PRODUCT 2: Oven glove – (fibres and fabrics)**



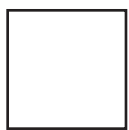
**PRODUCT 3: Electronic thermometer – (design engineering)**



**PRODUCT 4: Cutlery tray – (polymers)**



**PRODUCT 5: Food grater – (metals)**



**PRODUCT 6: Recipe book/tablet stand – (timbers)**

**Study and use the images and information about your chosen product given in the Insert.**

**5 The table below shows the manufacturing processes used to make your chosen product commercially.**

<b>Product</b>	<b>Commercial manufacturing process</b>
<b>Product 1: Recipe cards (papers and boards)</b>	<b>Lithography printed, lamination</b>
<b>Product 2: Oven glove (fibres and fabrics)</b>	<b>Quilted, overlapped and sewn</b>
<b>Product 3: Electronic thermometer (design engineering)</b>	<b>Surface mounted printed circuit board (PCB) OR injection moulded casing</b>
<b>Product 4: Cutlery tray (polymers)</b>	<b>Vacuum formed</b>

<b>Product</b>	<b>Commercial manufacturing process</b>
<b>Product 5: Food grater (metals)</b>	<b>Stamped and press formed</b>
<b>Product 6: Recipe book/tablet stand (timbers)</b>	<b>Lamination</b>

**(a) Explain the key features of the manufacturing process that has been used to manufacture your chosen product.**

**Include details of ANY JIGS, TEMPLATES AND FORMERS used.**

**You may use sketches and notes. [9]**

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[illegible]

[illegible]

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**(b) The choice of materials is important when designing products for use in a kitchen.**

**(i) Choose ONE material used in your chosen product. Identify TWO properties of the material that make it suitable for the product.**

**Material** \_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

**[2]**

**(ii) Describe TWO environmental factors the designer may have considered when selecting the specific material(s) used in your chosen product.**

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

\_\_\_\_\_

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

\_\_\_\_\_ **[2]**

**(c) Designers often use iterative models when designing new products.**

**(i) Explain THREE reasons why designers use iterative modelling during the design process. [6]**

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



3

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**(ii) Describe the materials or techniques you could use in a school workshop to make TWO DIFFERENT early iterative models of your chosen product.**

**Include details of:**

- any tools or processes**
- the methods you would use.**

**[6]**

**Iterative model 1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Iterative model 2** \_\_\_\_\_

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**6 You should use the SAME product you chose for Question 5 to answer this question.**

**(a) When designing products for use in a kitchen environment ergonomics must be considered.**

**Describe TWO ergonomic features of your chosen product.**

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

\_\_\_\_\_

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

\_\_\_\_\_

**[4]**

**(b)\*‘Form follows function’ is a principle often used to describe when the aesthetic shape of a product is based on its function.**

**Discuss the importance of this principle when designing products suitable for use in a kitchen.**

**Use examples to support your answer. [8]**

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**END OF QUESTION PAPER**

## ADDITIONAL ANSWER SPACE

**If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).**

This image shows a blank sheet of white paper with horizontal ruling lines. A single vertical line runs down the left side, creating a narrow margin. There are ten horizontal lines spaced evenly across the page, starting from the top margin line and extending to the right edge. The lines are thin and black.

[illegible]



[illegible]



[illegible]

[illegible]

[illegible]

[illegible]






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