Modified Enlarged 18pt

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Monday 16 May 2022 – Afternoon

AS Level in Design and Technology: Product Design

H006/01 Principles of Product Design

Time allowed: 1 hour 45 minutes plus your additional time allowance

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

Please write clearly in black ink.

Centre number | | | | | |

Candidate number | | | | |

First name(s) _____

Last name _____

READ INSTRUCTIONS OVERLEAF

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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. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question numbers.

Answer ALL the questions.

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 90.

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.

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Answer ALL the questions.

1 FIG. 1.1 shows a hardwood step stool.

FIG. 1.1

(a) (i) **Name a suitable hardwood for the step stool.**

_____ **[1]**

(ii) **State TWO properties of the material you have identified in part (a)(i) that make it suitable for the step stool.**

Justify EACH of your answers.

1 _____

_____

_____

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2 _____

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[4]

(b) **The step stool is manufactured so that it can be bought as a flat pack and assembled at home.**

FIG. 1.2 shows an exploded diagram of the step stool framework.

FIG. 1.2

(i) **Identify a suitable standard fixing or component that could be used to join part A to part B as shown in FIG. 1.2.**

_____ **[1]**

(ii) **Give TWO benefits to the manufacturer of using standard fixings or components.**

Justify EACH of your answers.

1 _____

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2 _____

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[4]

(c) (i) **Identify TWO DIFFERENT types of jig that could be used in the manufacture of the step stool.**

For EACH type of jig state ONE way in which it would be used in the manufacturing process.

1 _____

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[4]

(ii) **Discuss the importance of jigs in commercial production.**

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_____ **[6]**

2 **FIG. 2.1 and FIG. 2.2 show a fitness tracker. A fitness tracker is a wearable device that records the user's physical activity and other health-related data.**

FIG. 2.1

FIG. 2.2

(a) TABLE 2.3 shows data that has been collected from a survey of 800 people asking the main reason why they use fitness trackers.

TABLE 2.3

Reason	Number of people
A: To improve fitness	400
B: To improve sleep	200
C: To lose weight	100
D: To train for an event	75
E: Other reason	25

Use the template below to present the data given in TABLE 2.3 as a pie chart. Show your working. [3]

(b) The fitness tracker is to be adapted for teenagers.

TABLE 2.4 shows a sample of anthropometric data collected for children's wrists.

FIG. 2.5 shows an illustration of the fitness tracker strap.

FIG. 2.5

(i) Use TABLE 2.4 to identify the minimum length A and maximum length B of the fitness tracker strap if it was made to fit most girls and boys aged 13–18.

Minimum length A _____cm

Maximum length B _____cm [1]

TABLE 2.4

Wrist percentile values (cm) for 13–18 year olds											
Percentile		3rd	5th	10th	25th	50th	75th	85th	90th	95th	97th
Girls	Age										
	13	13.4	13.6	14.0	14.7	15.3	16.0	16.4	16.7	17.1	17.4
	14	13.8	13.9	14.2	14.8	15.4	16.1	16.6	16.8	17.3	17.5
	15	13.9	14.1	14.4	14.9	15.6	16.2	16.6	16.9	17.3	17.6
	16	13.9	14.1	14.4	14.9	15.6	16.2	16.7	17.0	17.4	17.8
	17	13.9	14.1	14.4	14.9	15.6	16.3	16.8	17.0	17.5	17.8
	18	13.9	14.1	14.4	15.0	15.7	16.4	16.9	17.2	17.7	18.1
Boys	Age										
	13	13.6	13.9	14.2	14.9	15.7	16.5	17.0	17.3	17.8	18.1
	14	14.0	14.3	14.7	15.2	16.0	16.7	17.2	17.5	18.0	18.3
	15	14.3	14.6	14.9	15.5	16.2	16.9	17.3	17.6	18.0	18.3
	16	14.6	14.8	15.1	15.7	16.4	17.1	17.4	17.7	18.1	18.3
	17	14.7	14.9	15.3	15.9	16.5	17.2	17.6	17.8	18.2	18.4
	18	14.8	15.0	15.4	16.0	16.7	17.3	17.7	17.9	18.3	18.6

(ii) FIG. 2.5 shows six strap holes equally spaced. Calculate the length of the fitness tracker strap in cm to 2 decimal places if the user sets it to strap hole C. Show your working. [3]

Length of fitness tracker strap _____ cm

(c) The fitness tracker can be programmed to calculate steps and step goals.

FIG. 2.6 shows a graph that links the resting heart rate to the average step count per day.

FIG. 2.6

Intensity of Exercise Drives Resting Heart Rate

Use FIG. 2.6 to identify the optimum average step count a low intensity walker needs per day to reduce their resting heart rate. [1]

Optimum average step count _____

(d) To calculate a female stride length in cm:

Height (cm) × 0.413

A 156 cm-tall female takes 10 000 strides. Use the information above to calculate the distance she has travelled in km to 2 decimal places. Show your working. [3]

Distance _____ km

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3 FIG. 3.1 shows a metal container (part A) with an integral hinged lid (part B).

FIG. 3.1
(not to scale)

(a) The container shown in FIG. 3.1 is manufactured from sheet metal.

Name a suitable sheet metal for the container.

Justify your answer.

_____

_____

_____

_____ [2]

(b) Use annotated sketches and/or notes to show how part A of the container shown in FIG. 3.1 would be manufactured as a batch of 80 000 from sheet metal.

Identify any relevant equipment, machinery and materials. [8]

(c) Use annotated sketches and/or notes to show how the blue surface finish shown in FIG. 3.1 would be applied to the outer surface of the batch of 80 000 containers.

Identify any relevant equipment, machinery and materials. [6]

(d) **Explain the reasons for undertaking risk assessments during the manufacturing processes described in PART (b) and PART (c).**

_____

_____

_____

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_____

_____ **[3]**

4 **FIG. 4.1 shows a multi-tool. A multi-tool is a small device that incorporates several fold-out tools in one product.**

FIG. 4.1

(a) Identify TWO features of the multi-tool shown in FIG. 4.1 that enhance its aesthetic appeal.

Justify EACH of your answers.

1 _____

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2 _____

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[4]

(b) **Identify TWO features of the multi-tool shown in FIG. 4.1 that enhance its usability.**

Justify EACH of your answers.

1 _____

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2 _____

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[4]

(c) The scissor tool part A shown in FIG. 4.1 is made from a ferrous metal.

(i) State a suitable ferrous metal for the scissor tool part A.

_____ [1]

(ii) Identify and describe a suitable industrial process that could be used to manufacture the scissor tool part A.

_____

_____

_____

_____ [2]

(d) The designer of the multi-tool conducted a survey of 800 people to determine an appropriate price range for the product.

Complete TABLE 4.2 below to calculate:

(i) how many people chose each price range. [1]

(ii) the frequency density for each price range. [1]

Show your working.

TABLE 4.2

Price range (£) (*p* price)	People surveyed (%)	Number of people (frequency)	Class width	Frequency density
$0 \geq p \leq 5$	6			
$5 > p \leq 10$	31			
$10 > p \leq 20$	43			
$20 > p \leq 40$	20			

(iii) Draw a histogram on the grid below to represent the information you calculated in part (d)(ii). [1]

(iv) **Identify TWO OTHER methods of exploring stakeholder requirements and describe when EACH method would be used in the iterative design process.**

1 _____

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_____

_____

2 _____

_____

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_____

[4]

(e)* The design of today's products is often influenced by historical design movements, designers and their methods.

Identify a specific designer and discuss how their work and methods have influenced developments in product design.

Refer to specific examples in your answer. [8]

Chosen designer _____

_____

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5 (a) **Describe THREE ways in which planned obsolescence is designed into products.**

Refer to specific products in your answer.

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2 _____

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3 _____

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_____

[6]

(b)* **Discuss the impact of planned obsolescence on the environment.**

Refer to specific examples in your answer. [8]

END OF QUESTION PAPER

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