

Modified Enlarged 24pt
OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Friday 7 June 2019 – Morning

**A Level in Design and Technology:
Product Design**

H406/01 Principles of Product Design

**Time allowed: 1 hour 30 minutes
plus your additional time allowance**

YOU MAY USE:
a scientific calculator
a ruler
pencils/pens
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. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.

INFORMATION

The total mark for this paper is 80.

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

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

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Answer ALL the questions.

1 FIG. 1 shows three images of a selfie stick. A selfie stick is a hand held product used to take photographs or video by holding a smartphone, beyond the normal range of the arm.

(a) Analyse FIG. 1 to identify TWO design features of the selfie stick that ensure it functions as intended. Justify EACH of your responses.

1 _____

2 _____

[4]

FIG. 1

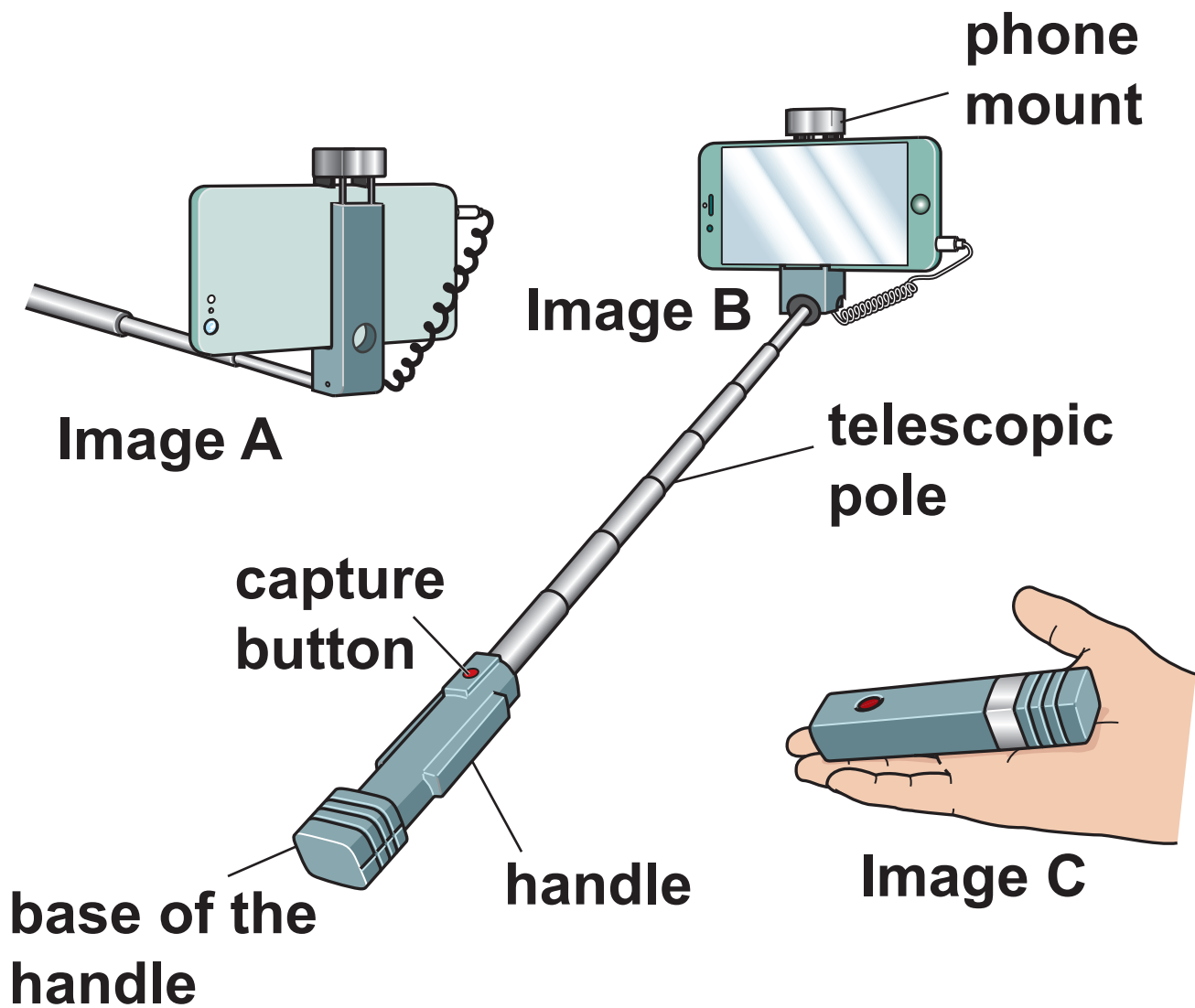


Image A: Shows a close up of the phone mount

Image B: Shows the selfie stick extended and ready for use

Image C: Shows the compact selfie stick folded away

- (b) Name ONE metal that is suitable for the telescopic pole of the selfie stick and explain why this would be used.**

[2]

- (c) The maximum length of the selfie stick is 585mm from the base of the handle to the phone mount. The handle is 116mm long and the rest of the extension comes from the telescopic pole.**

The telescopic pole is made up of 7 sections.

Each section is cut to the same length.

3mm of each section is covered by the larger section next to it including the section attached to the handle.

Calculate the length of one section of the telescopic pole in mm. Show your working. [2]

Length of one section _____mm

(d) Explain THREE advantages to the designer of the selfie stick of using modelling during the iterative design process.

1 _____

2 _____

3 _____

[6]

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(e) Design optimisation is an important part of the iterative design process.

Discuss how the design and manufacture of the selfie stick could be optimised to keep costs as low as possible. [6]

- (f) Past and present technologies and design thinking have influenced the development of products in many different ways.**

Describe THREE ways that past and present technologies and design thinking have influenced products such as the selfie stick. [6]

1 _____

2 _____

3

2 FIG. 2.1 shows two views of a remote control for an electronic device.

FIG. 2.1



- (a) The top surface of the battery hatch, shown in FIG. 2.1, is a rectangle measuring 30 mm wide and 60 mm long correct to the nearest mm. Calculate the upper bound of the area of this rectangle in mm^2 . Show your working. [2]

Upper bound _____ mm^2

- (b) The remote control batteries have a life span of approximately 75 hours. The remote control is used, on average, approximately 3 minutes every day. Estimate the number of years before the user will have to replace the batteries. Show your working. [2]**

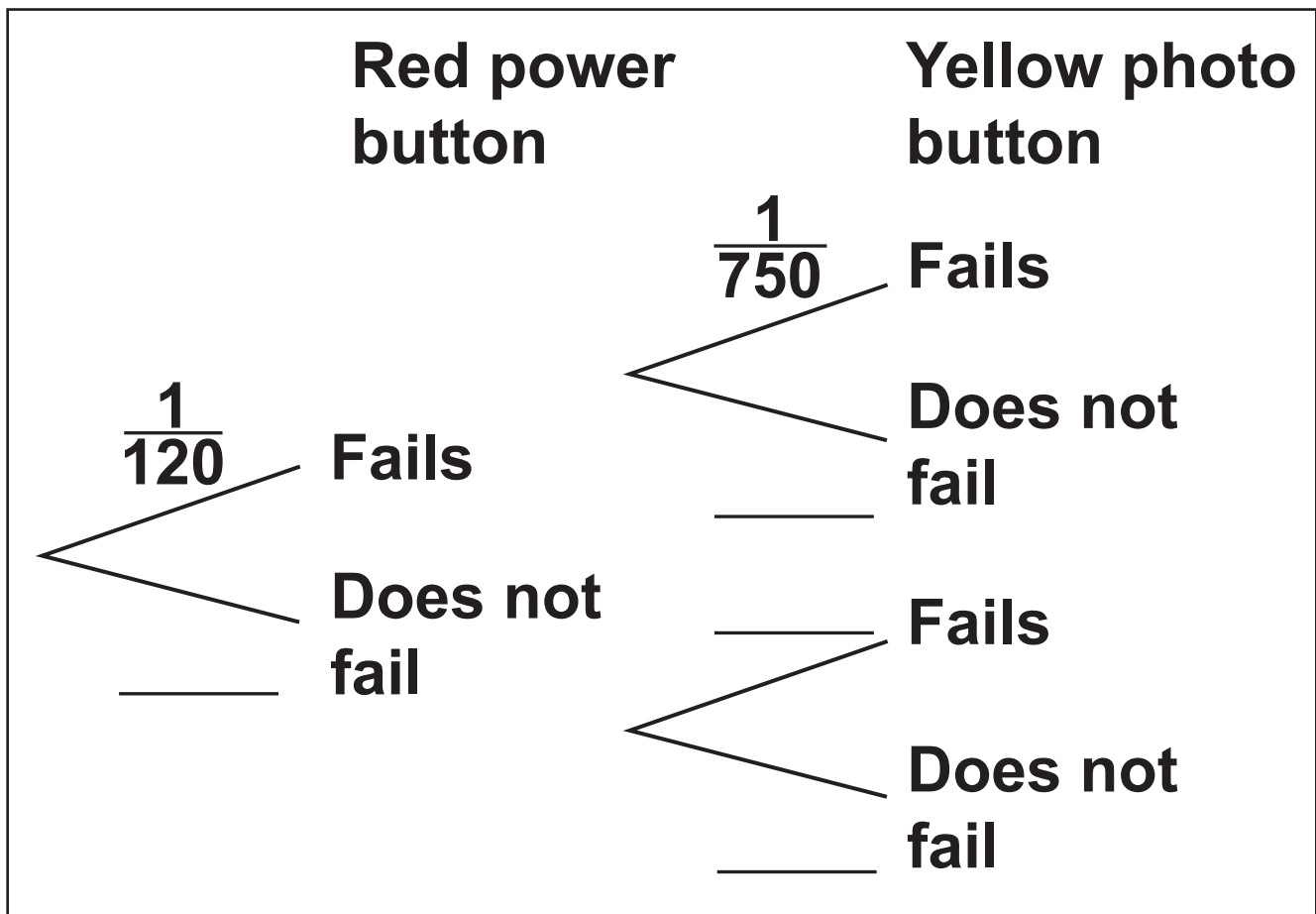
Approximately _____ years

- (c) During quality control testing the red power and yellow photo buttons sometimes failed.

The probability that the red power button fails is $\frac{1}{120}$

The probability that the yellow photo button fails is $\frac{1}{750}$

- (i) Complete the probability tree diagram below. [2]



(ii) Calculate the probability that both buttons fail. Show your working. [2]

Probability _____

(d) Describe TWO ways in which ergonomic factors would be considered when designing the buttons on the remote control.

1 _____

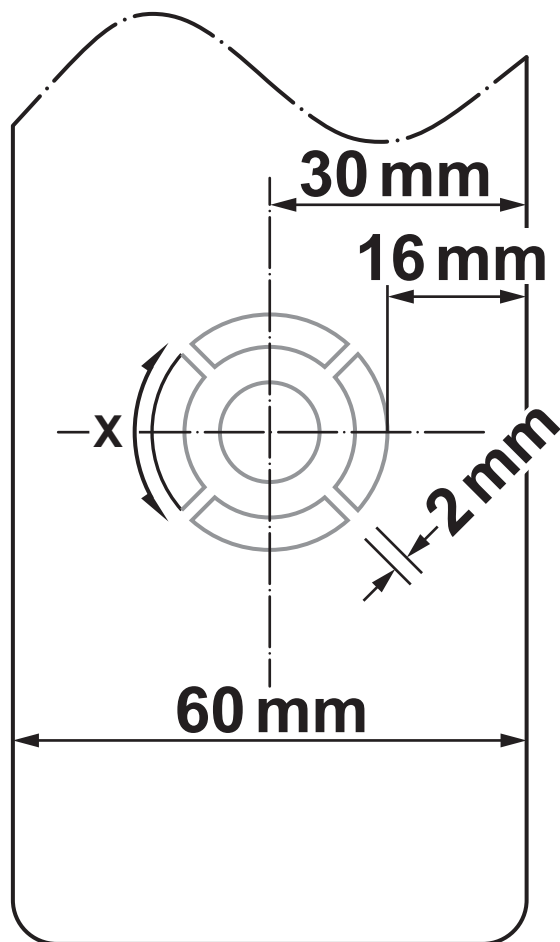
2 _____

[4]

FIG. 2.2 shows a CAD diagram of the central buttons in the lower part of the remote control.

Arc X is part of the outer circumference of a circular array of four identical buttons.

FIG. 2.2
(not to scale)



- (e) Using the diagram in FIG. 2.2, calculate the length of arc X in mm to 2 decimal places. Show your working. [4]

The formula used to calculate the arc length of a circle is

$$\frac{\theta}{360^\circ} \times 2\pi r$$

Length of arc X _____ mm

3 The understanding and use of lifecycle assessment (LCA) is important in the design and manufacture of products.

(a) Describe what is meant by the term LCA.

[4]

(b) Discuss the importance of LCA and its influence on design practice and product development.

Use specific examples to support your response. [8]

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- 4 FIG. 4.1 shows a hover board. A hover board is a personal transporter which is self-balancing and allows the user to travel short distances by tilting their body in the direction of travel.**

FIG. 4.2 shows the outer shell of the hover board.

FIG. 4.3 shows the four component parts of the outer shell of the hover board.

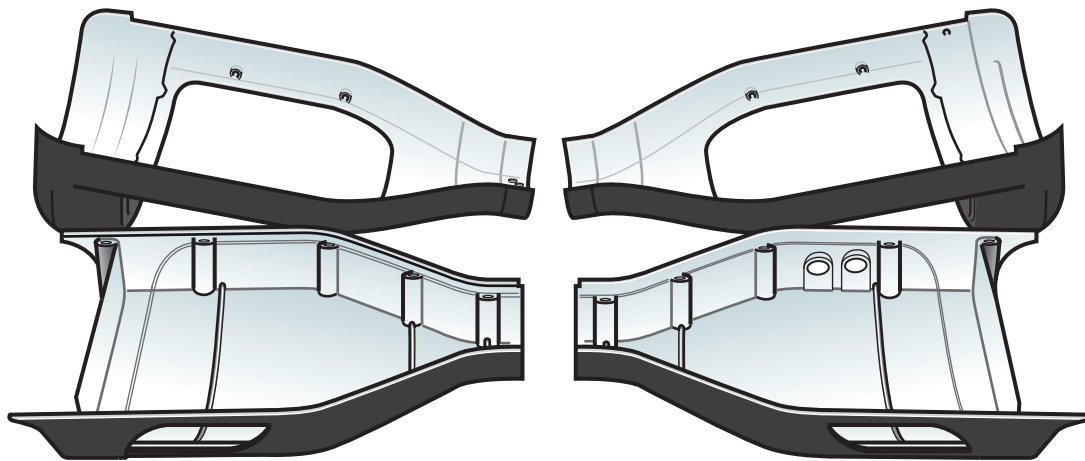
FIG. 4.1



FIG. 4.2



FIG. 4.3



(a) The outer shell of the hover board shown in FIG. 4.2 is manufactured as a batch of 10 000.

(i) Name ONE suitable thermopolymer for use in the manufacture of the component parts of the outer shell of the hover board shown in FIG. 4.3 and explain why it would be used.

[2]

(ii) Identify a suitable manufacturing process for the component parts of the outer shell of the hover board shown in FIG. 4.3.

[1]

(iii) Use annotated sketches and/or notes to show how the process you have identified in PART (a)(ii) would be used to manufacture the component parts of the outer shell of the hover board as a batch of 10 000.

Identify any relevant specialist tooling and quality control checks. [8]

(iv) Describe TWO ways that the principles of designing for manufacture (DFM) have been incorporated in the design of the outer shell of the hover board.

1 _____

2 _____

[4]

- (b) The hover board covers a distance of 2.4 km in 20 minutes.**

Calculate the average speed of the hover board in metres per second (m/s). Show your working. [3]

Average speed _____ m/s

(c)*Designers and manufacturers have a responsibility to meet legislative and standards requirements when creating commercial products.

Discuss the implications to the designer and manufacturer of applying legislative and standards requirements to commercial products.

Refer to specific products in your response.

[illegible]

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).

[illegible]



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