

Surname
Other Names

St Paul's School

Monday, 11 May 2020 - Morning

6th form assessment

Engineering Department
Systems & Control

1 hour



For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	13	
2.	18	
3.	15	
4.	12	
Total	58	

ADDITIONAL MATERIALS

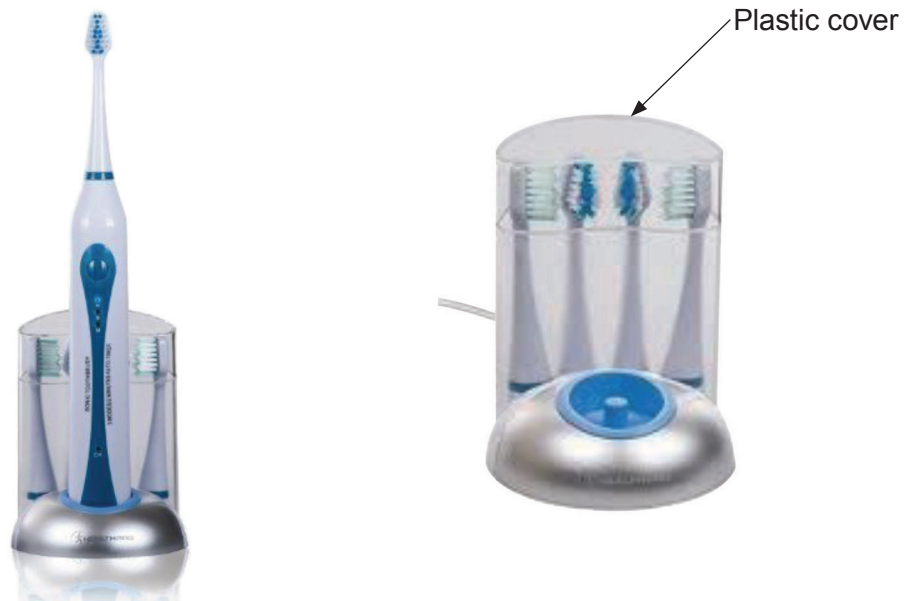
You will need basic drawing equipment, coloured pencils and a calculator for this examination.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

1. This question is about Product Analysis. It is worth a total of 13 marks.

- (a) Study the information about the rechargeable electronic toothbrush and dock shown below.



Product Features

- Sonic toothbrush with 34,000 strokes per minute.
- Three modes: power clean, gentle and massage.
- Easy to remove brush heads.
- Timer / Alert – auto shut off after 2 minutes of brushing. Auto alert when brushing the same area for more than 30 seconds.
- Includes dock, charging unit and storage for 4 brush heads.
- RRP £39.99.

- (i) Underline the most suitable scale of production for the rechargeable electronic toothbrush and dock. [1]

Batch Production

One-Off Production

- (ii) Give **one** reason for the plastic cover on the storage container. [1]

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- (iii) Explain the reason for including 4 brush heads. [2]

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(b) Study the **two** specification points below and explain how these have been met by the product.

(i) The electronic toothbrush must improve oral hygiene for the user. [2]

Explanation:

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(ii) The electronic toothbrush must be sustainable. [2]

Explanation:

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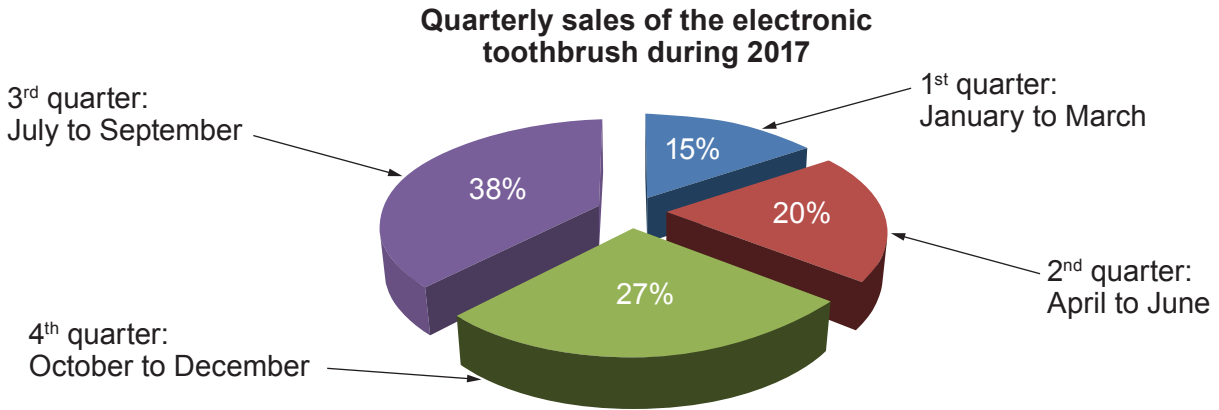
(c) Describe how the aesthetics of the electronic toothbrush and dock would appeal to the target market. [2]

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(d) The pie chart below shows the quarterly sales totals for the electronic toothbrush following its release in January 2017.



(i) Give **one** reason why the sales of the electronic toothbrush steadily increase during the year. [1]

(ii) During the April to June quarter 450 electronic toothbrushes were sold. Calculate the total annual sales for the 2017 period. [2]
 (Show all workings.)

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2. This question is about the Design Process and how it is used. It is worth a total of 18 marks.

An initiative to improve healthy lifestyles has been launched.

You are required to design and make a device to encourage children to eat healthy food products at least 5 times per day.



Examiner
only

Specification

The device must:


- be battery powered and fit to a refrigerator door;
- monitor whether or not children have eaten 5 healthy options during the day;
- be easy to switch on and off and include a method of resetting the device every day;
- have a fun theme to encourage healthy lifestyles, including light and sound when 5 healthy options have been eaten in one day.

Marks will be awarded for:

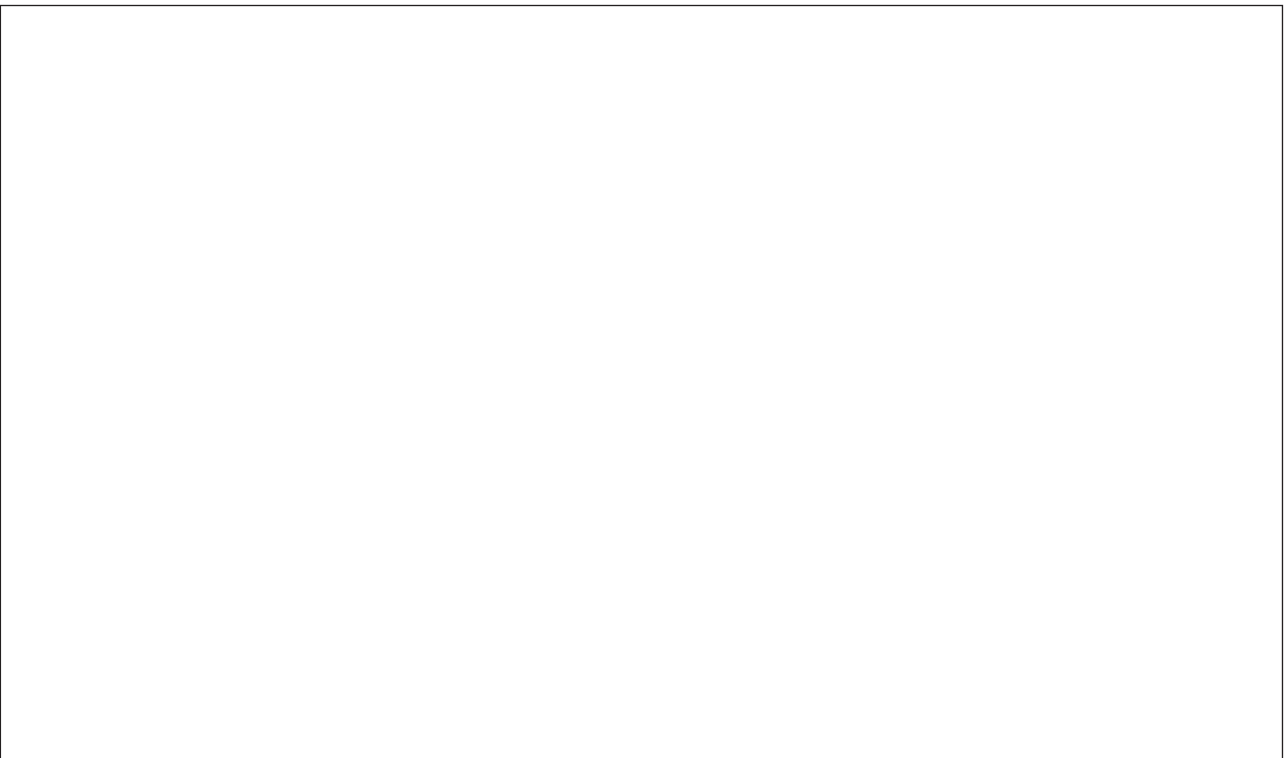
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|---|-----|
| (i) a block diagram of the electronic system used; | [3] |
| (ii) fully labelled details of the overall look of the device; | [4] |
| (iii) details of the electronic circuit used in the device; | [5] |
| (iv) details of how the device is fun, encourages healthy lifestyles and fits to a refrigerator door; | [2] |
| (v) sizes, materials and quality of communication. | [4] |

Draw a block diagram of the electronic system in the box below.

Draw fully labelled details of the overall look of the device in the box below, including how it fits onto a refrigerator door.

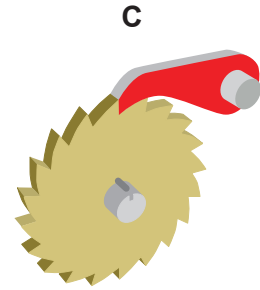
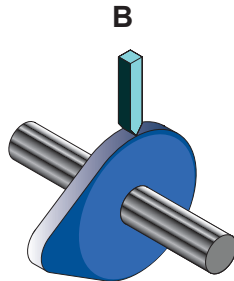
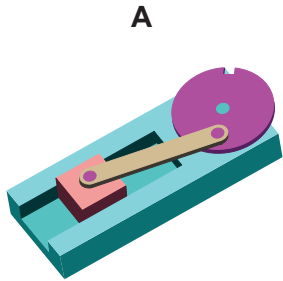


Draw details of the electronic circuit used in the box below.



3. This question is about Materials and Components. It is worth a total of 15 marks.

(a) Study the images of the mechanisms below.



(i) State the name given to mechanism **A**. [1]

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(ii) Mechanism **B** transfers rotary motion to motion. [1]

(iii) State the name of mechanism **C** and explain how this system works.

Name: [1]

Explanation:

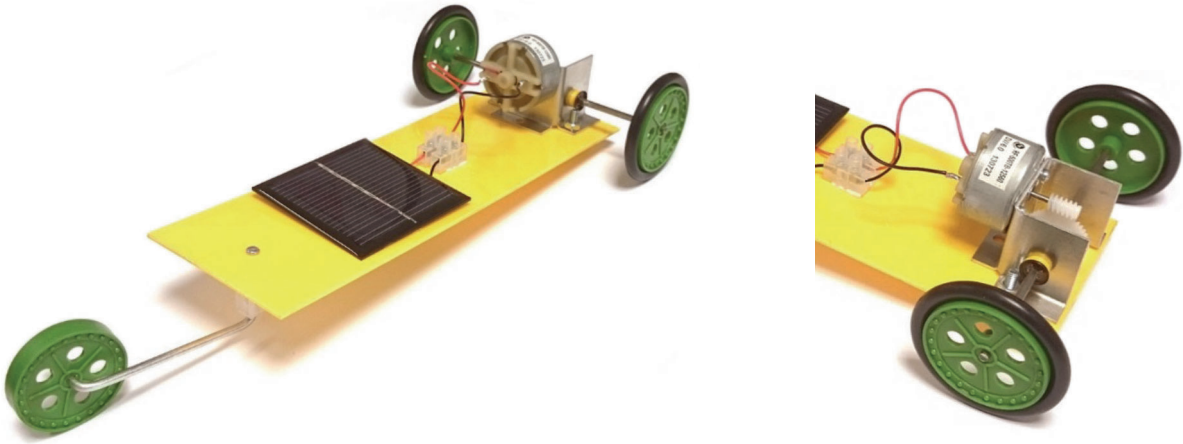
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[2]

(b) A student has produced the buggy shown below.



(i) State the name of the power source component used in the buggy. [1]

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(ii) The buggy is driven using a worm drive and spur gear with 20 teeth. Calculate the rotational velocity (RV) of the back wheels if the motor provides 120 rpm. [2]
(Show all workings.)

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(iii) Explain what needs to happen for the buggy to move faster. [2]

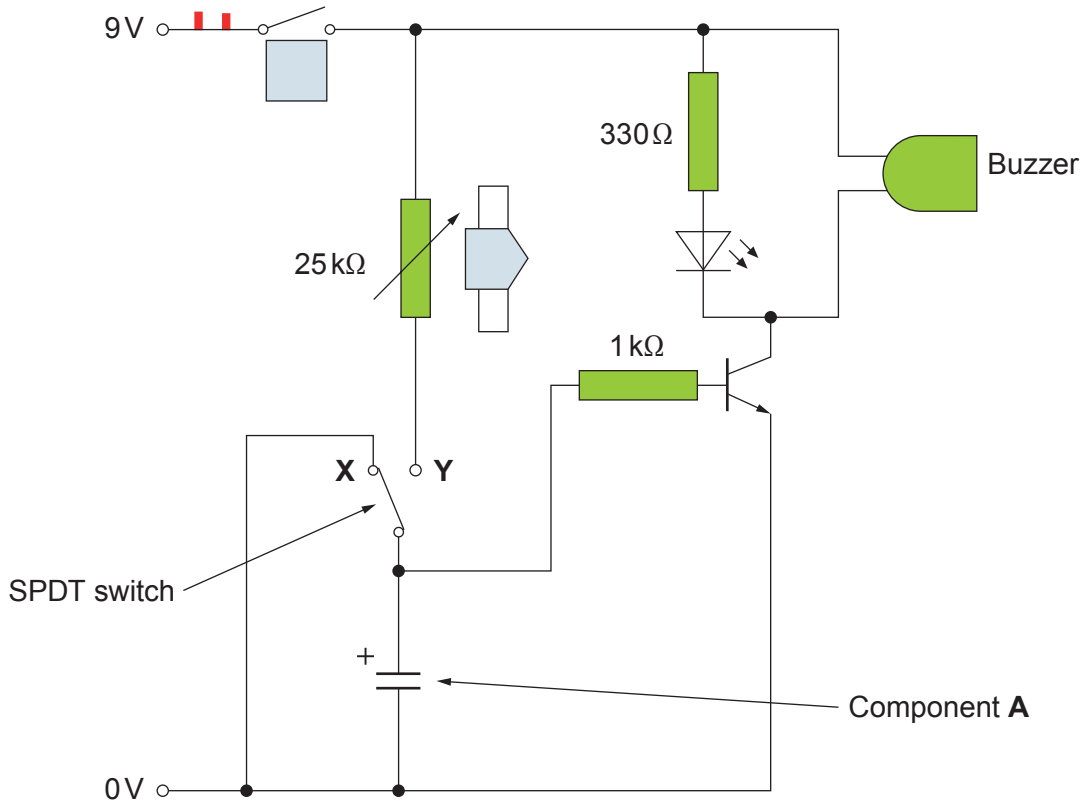
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(c) Study the electronic control system shown below.



(i) The SPDT (Single Pole Double Throw) switch can be placed in position **X** and position **Y** (as shown). Describe what happens when the circuit is switched on and the SPDT switch is placed in position **Y**. [3]

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(ii) Explain the role of Component **A**. [2]

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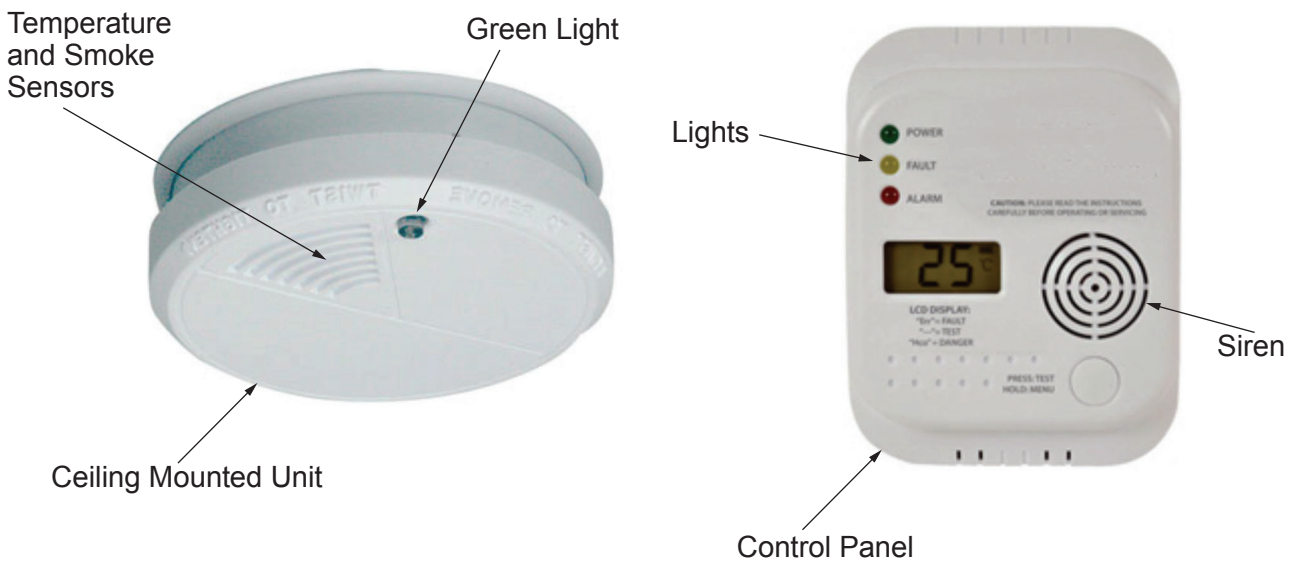
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4. This question is about ICT,CAD,CAM,Systems and Processes. It is worth a total of 12 marks.

(a) The fire detection device below shows a ceiling mounted sensing system and control panel.

- A green light illuminates when power is on.
- A yellow 'Fault' light illuminates and a siren sounds if the temperature reaches a preset value on the control panel.
- If smoke is detected the red 'Alarm' light flashes and a siren sounds to warn people to evacuate the building.



(i) Complete the table by placing a **tick (✓)** to show whether the statement is true or false. 2 × [1]

	True	False
The siren is an input device.		
The temperature sensor is an output of the system.		

(ii) Explain why the fire detection device is both mains and battery powered. [2]

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(b) The flowchart below shows how the fire detection device is controlled.

Complete the flowchart by placing the statements in the correct positions and adding any missing feedback loops. [8]

