Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4121/01

S18-4121-01

DESIGN AND TECHNOLOGY
UNIT 1
FOCUS AREA: Systems and Control Technology

WEDNESDAY, 23 MAY 2018 – MORNING

2 hours

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	**15**	
	2.	**10**	
	3.	**10**	
	4.	**25**	
Section B	**5.**	**10**	
	6.	**15**	
	7.	**20**	
	8.	**15**	
	Total	**120**	

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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.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. Where the space is not sufficient for your answer, continue at the back of the booklet, taking care to number the continuation correctly.

You are reminded of the necessity for good English and orderly presentation in your answers.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

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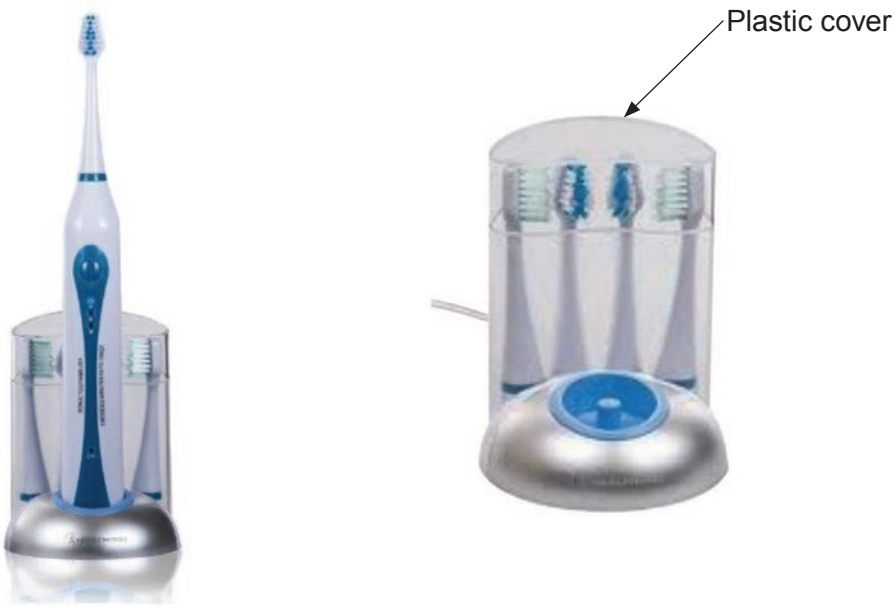
Section A

Marked out of 60 60 minutes

1. This question is about Product Analysis. It is worth a total of 15 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) Users can purchase replacement packs of brush heads, like the ones shown below, for £4.85.

Describe **one** advantage to the manufacturer of users purchasing replacement packs of brush heads. [2]

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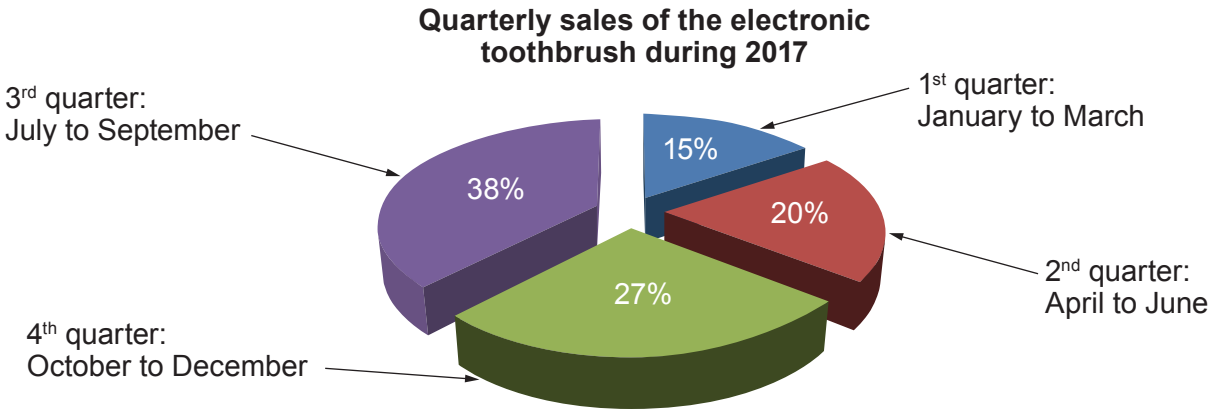
(e) The pie chart below shows the quarterly sales totals for the electronic toothbrush following its release in January 2017.



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

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(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 general issues of Design and Technology. It is worth a total of 10 marks.

(a) Complete the table by adding the correct R for each of the descriptions.

To take a component or part from a waste product and place it in a different product, instead of throwing it away.	R ..... [1]
To fix a broken product to avoid buying a new one.	R ..... [1]

(b) Describe the meaning of **each** of the logos shown below.

(i) Meaning: .....

..... [1]

(ii) Meaning: .....

..... [1]

(c) Global manufacturing involves using different countries and sources to produce products. Explain how global manufacturing can create winners and losers. [3]

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(d) The image shows a tidal power system. Describe the advantages of using tidal power over alternative sources of renewable energy. [3]

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Turn over.

Examiner only

3. This question is about the Designers that you have studied. It is worth a total of 10 marks.

During your course you have studied the work of Shigeru Miyamoto and James Dyson.

(a) Write the name of the designer responsible for **each** of the products shown below. 2 × [1]

Designer: ..... Designer: .....

(b) Write a short essay in the space below describing the work of James Dyson or Shigeru Miyamoto, identifying the main reasons for the success of their famous products. [8]

Marks will be awarded for the content of the answer and the quality of written communication.

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4. This question is about the Design Process and how it is used. It is worth a total of 25 marks.

(a) Name **two** Research Strategies used to gather information about a design problem.

Research Strategy 1: ..... [1]

Research Strategy 2: ..... [1]

(b) Describe how designers can use CAD (Computer Aided Design) when developing design ideas. [2]

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(c) Explain the difference between an ongoing evaluation and a final evaluation. [3]

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(d) 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.

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:

(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.

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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.

Turn over.

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Section B

Marked out of 60 60 minutes

5. This question is about Commercial Manufacturing Processes. It is worth a total of 10 marks.

(a) State the correct scales of production for the descriptions below.

	Description	Scale of production	
(i)	An individual product made to order.	.....	[1]
(ii)	Lots of products manufactured in a limited time.	.....	[1]
(iii)	Identical products manufactured without stopping.	.....	[1]

(b) The reflow soldering machine below is used in industry when constructing printed circuit boards.

(i) Complete the table below by naming the **three** missing stages when a printed circuit board is manufactured using reflow soldering. 3 × [1]

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
....	Components added	....	Reflow	....

(ii) Describe what happens at the 'Reflow' stage. [2]

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(c) Explain **one** main advantage to the manufacturer of using reflow soldering over the through-hole method. [2]

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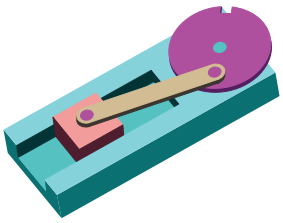
Turn over.

Examiner only

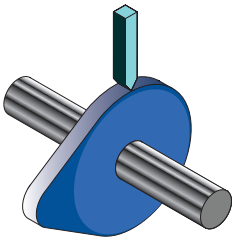
6. This question is about Materials and Components. It is worth a total of 15 marks.

(a) Study the images of the mechanisms below.

A



B



C

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

.....

(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]

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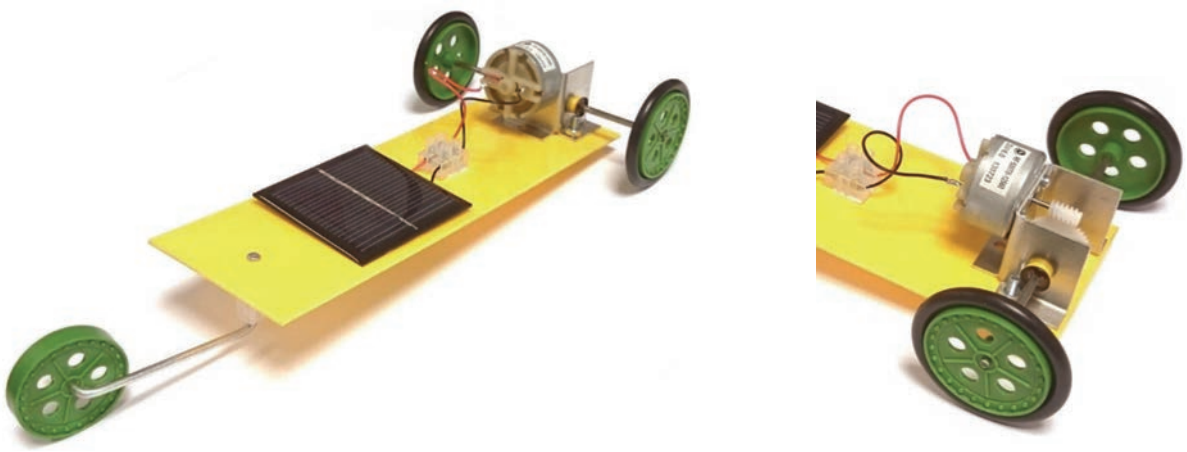
(b) A student has produced the buggy shown below.



(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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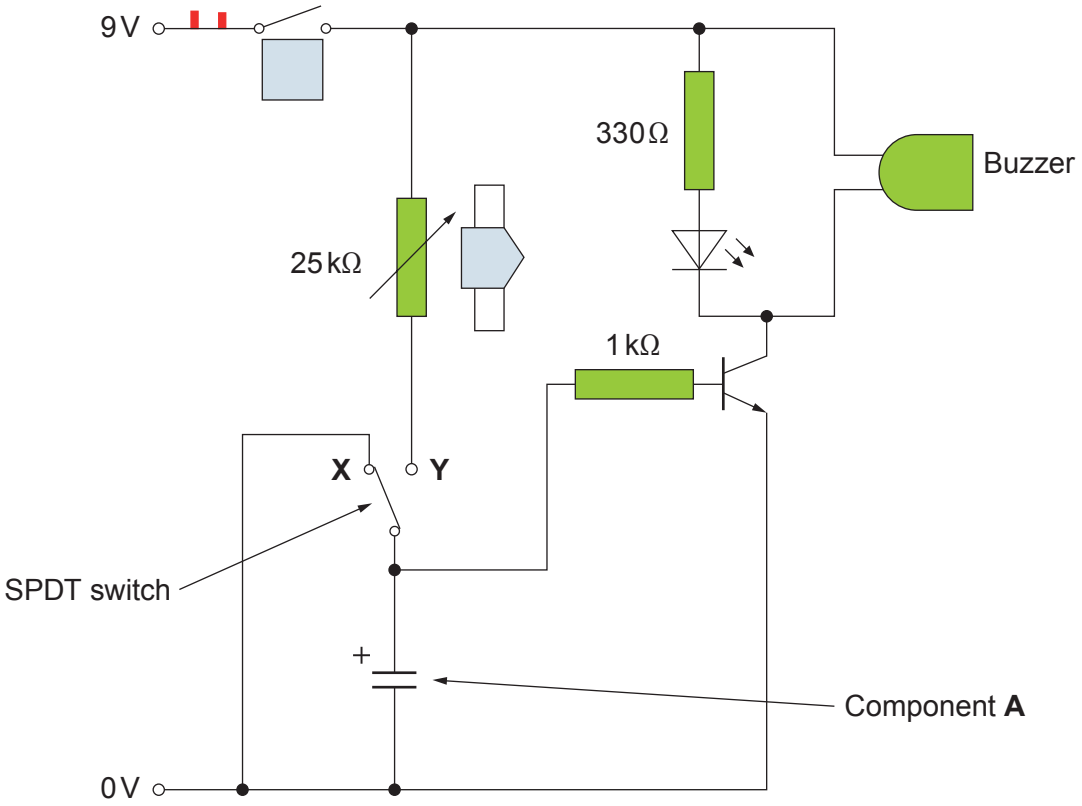
(c) Study the electronic control system shown below.



(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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7. This question is about Tools, Equipment and Making. It is worth a total of 20 marks.

(a) State the correct name of the tools shown below.

		
.... [1]	.... [1]	.... [1]

(b) State the meaning of **each** of the workshop symbols shown below. 2 × [1]

Meaning: .....

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Meaning: .....

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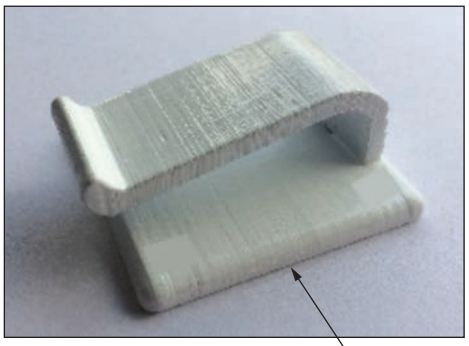
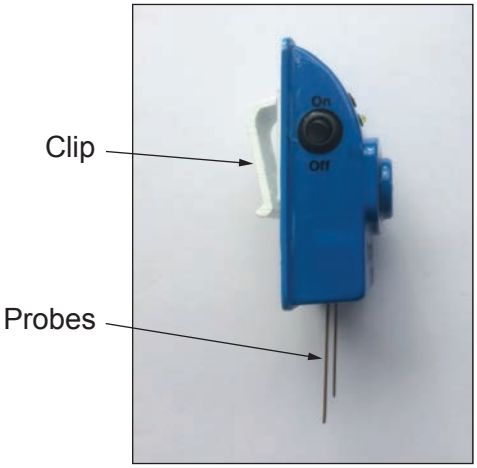
(c) The water level sensing device below has been designed by a student and manufactured in a school workshop.





(i) Name a suitable metal material to be used to make the probes. [1]

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(ii) Name a suitable plastic material to be used to make the casing for the device. [1]

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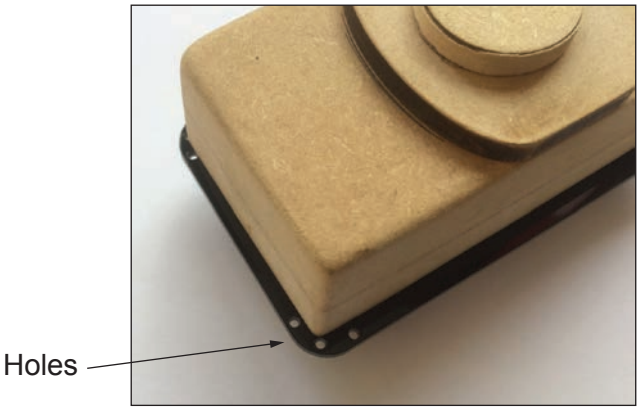
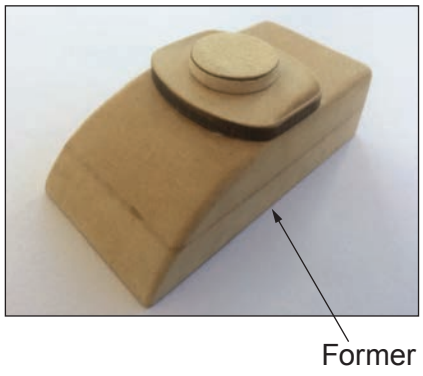
(iii) Using notes and sketches, describe how you use a temporary fixing to fit the white clip to the back of the device. [3]





(iv) Explain the reason for the holes in the black layer shown. [2]

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(v) Describe in detail how the former used to make the casing has been constructed in a school workshop. [4]

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(vi) Inside the device, the metal probes need to be held securely. Using annotated sketches, show how you would securely fit the probes to the device, naming all tools and equipment required. [4]

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8. This question is about ICT, CAD, CAM, Systems and Processes. It is worth a total of 15 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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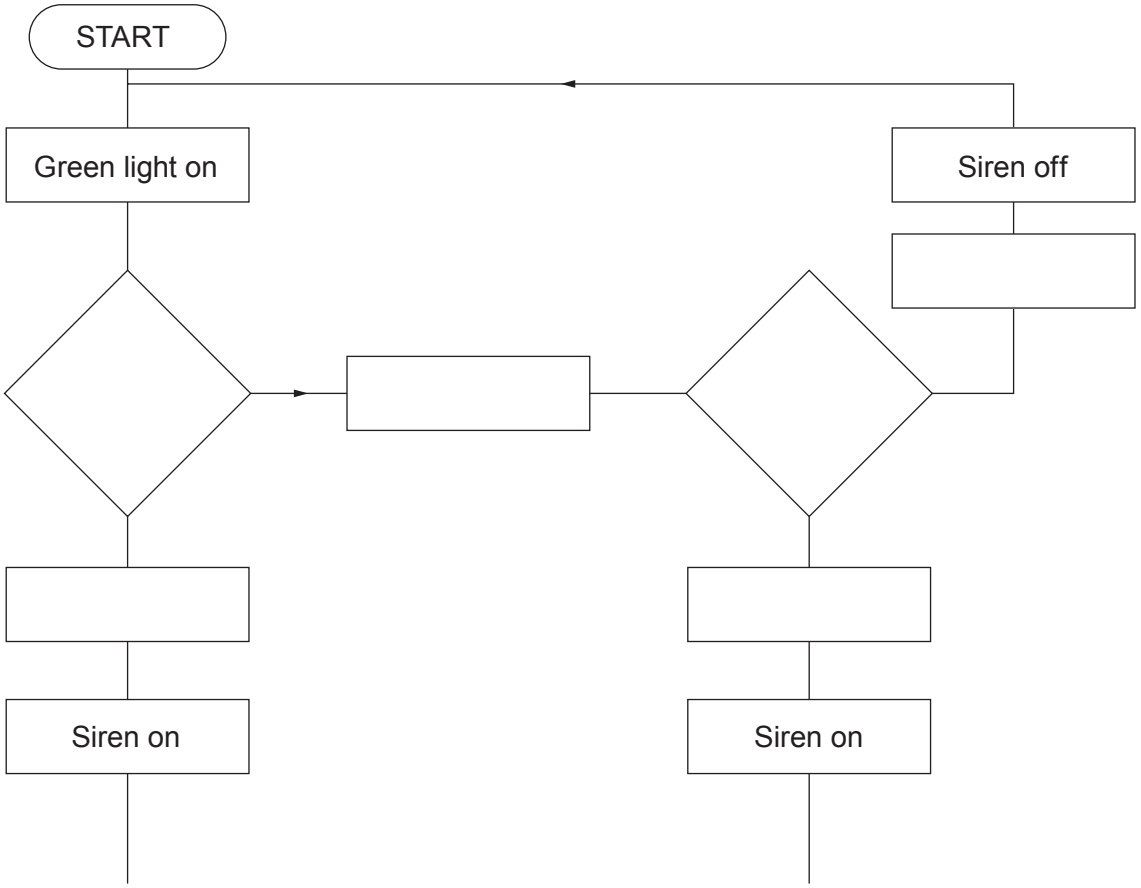
(b) The flowchart below shows how the fire detection device is controlled.

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



Statements

Yellow light off

Is smoke present?

Is preset temperature reached?

Red light flash

Yellow light on

Red light off

(c) Explain why a Programmable Interface Controller (PIC) would be a suitable component to control the fire detection device. [3]

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