

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

4121/01

DESIGN & TECHNOLOGY

UNIT 1

FOCUS AREA: Systems and Control Technology

P.M. FRIDAY, 23 May 2014

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 book, 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.

Section A

Marked out of 60 60 minutes

1. This question is about Product Analysis. It is worth a total of 15 marks.

A miniature games console has been launched to compete with existing products.



Features:

- 2 x LR44 batteries
- Steel keyring
- 3 different games available
- £8.99 (with free delivery)

(a) A design specification was produced before designing the miniature games console.

Write a detailed specification point for **each** of the following headings.

(i) Aesthetic appeal: [2]

.....

(ii) Size: [2]

.....

(iii) Function: [2]

.....

(b) (i) **Circle** the correct scale of production for the miniature games console. [1]

One-off Production Batch Production Continuous Flow Production

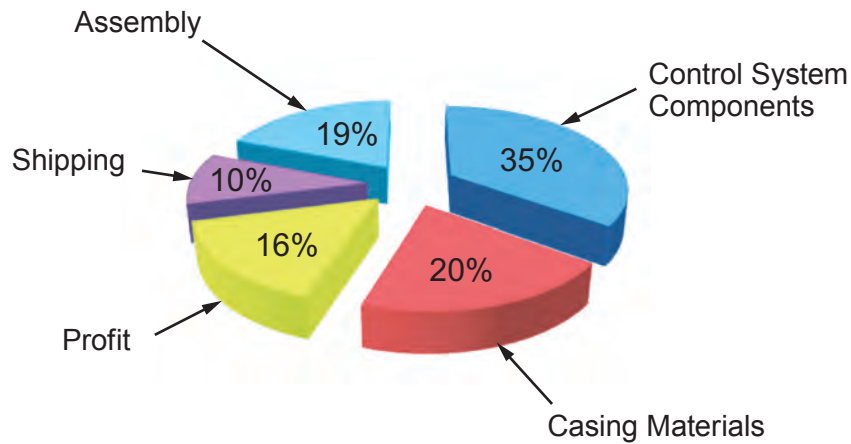
(ii) Explain why the miniature games console is produced in three colours with different games. [2]

.....
.....

(c) Describe the sustainability issues facing the designer when designing the miniature games console. [3]

.....
.....
.....

(d) The pie chart below shows percentages of the main costs of bringing the miniature games console to the marketplace.



(i) State the lowest cost. [1]

.....

(ii) The miniature games console is sold for £8.99. Calculate how much profit is made if 800 miniature games consoles are sold. (*Show all your workings.*) [2]

.....
.....

2. This question is about the general issues of Design and Technology. It is worth a total of 10 marks.

(a) State the name of the symbol shown below.



Name: [1]

(b) The images below show existing products and new products. State which of the 6 Rs the designer has considered. Give a detailed reason for your answers.



Existing torch



New torch

(i) R [1]

(ii) Reason [2]

.....



Existing bicycle light



New bicycle light

(iii) R [1]

(iv) Reason [2]

.....



(c) Describe how the build quality of a product affects the product life cycle.

[3]

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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) Study the descriptions below and **underline** the correct meaning for the term Design Brief. [1]

A review of the project after completion.

A step-by-step plan of making the product.

A statement describing the problem at the start of a project.

(b) Explain why designers disassemble existing products during research. [2]

.....
.....

(c) Explain the meaning of the symbol below. [2]



Explanation:

.....
.....

(d) Describe why designers undertake user trials with prototype products. [2]

.....
.....
.....
.....

- (e) A childrens' play centre requires you to design a warning device to be fitted to a doorframe to warn supervisors if a child opens the exit door.

Specification

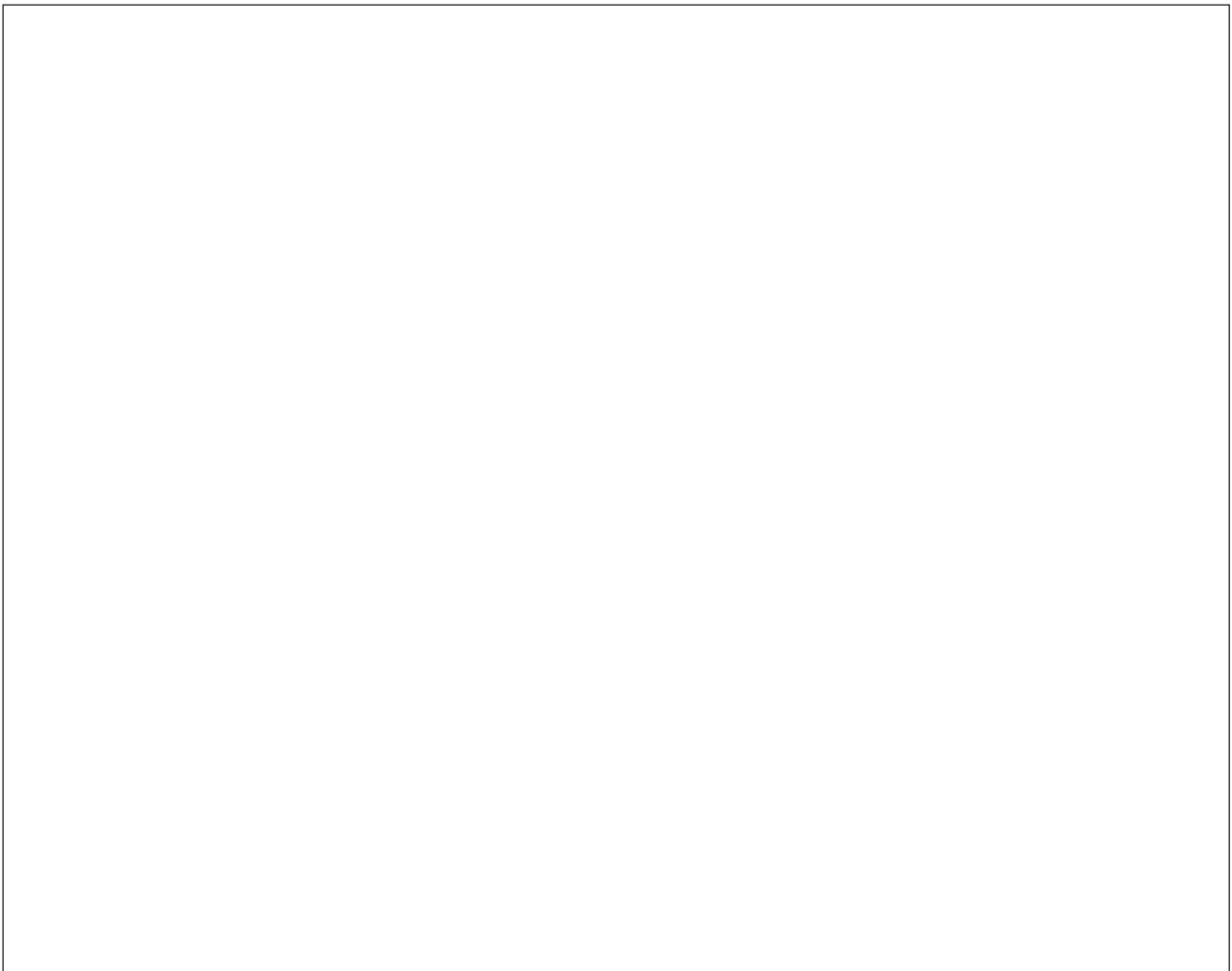
The device must:

- be battery powered and create a light and sound when triggered;
- keep the light and sound 'on' until reset by the supervisor;
- be made from suitable materials and fit securely to any wooden doorframe;
- include a method of resetting the device by the supervisor only.

Marks will be awarded for:

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

Draw fully labelled details of the overall look of the device in the box below.



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



Draw details of the electronic circuit used in the box below, including details of resetting the device.

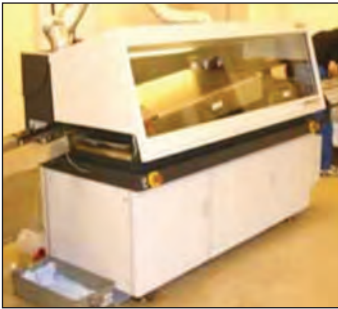
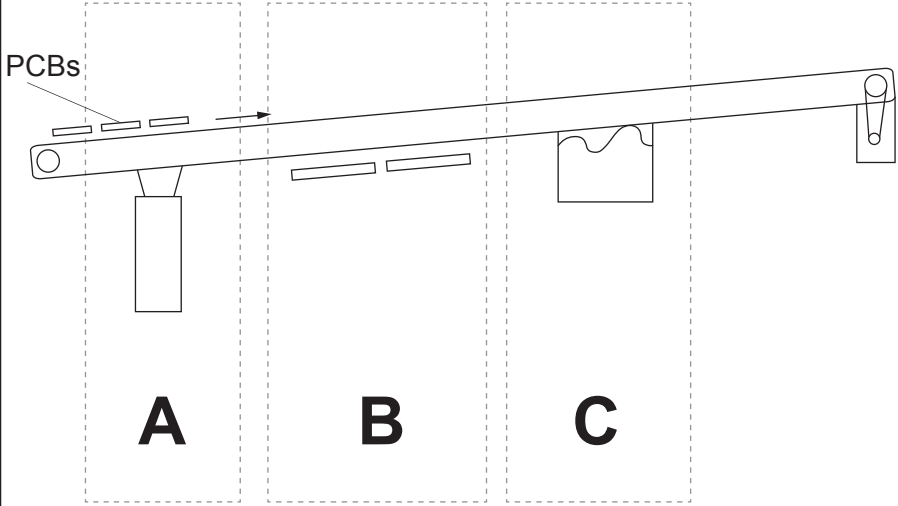


Section B

Marked out of 60 60 minutes

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

(a) Study the images of a wave soldering machine shown below.

<p>Wave Soldering Machine</p> 	<p style="text-align: center;">Diagram of Wave Soldering Machine</p> 
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Complete the table below by describing what happens to a PCB during the wave soldering process at stages **A**, **B** and **C**.

Stage	Description
A	<div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="text-align: right;">[2]</div>
B	<div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="text-align: right;">[2]</div>
C	<div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px dotted black; height: 15px; margin-bottom: 5px;"></div> <div style="text-align: right;">[2]</div>

(b) Explain why quality control checks are important to the manufacturer when producing products. [2]

.....

.....

.....

(c) The image below shows an automated final function test being carried out at the end of the assembly process.



Explain how automating the test procedure benefits the manufacturer. [2]

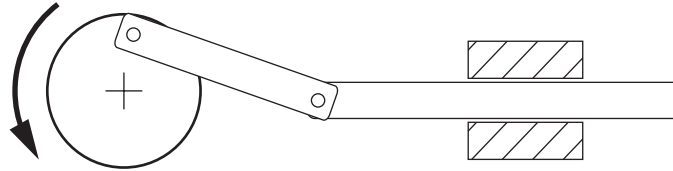
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6. This question is about Materials and Components. It is worth a total of 15 marks.

(a) Study the mechanism shown below.



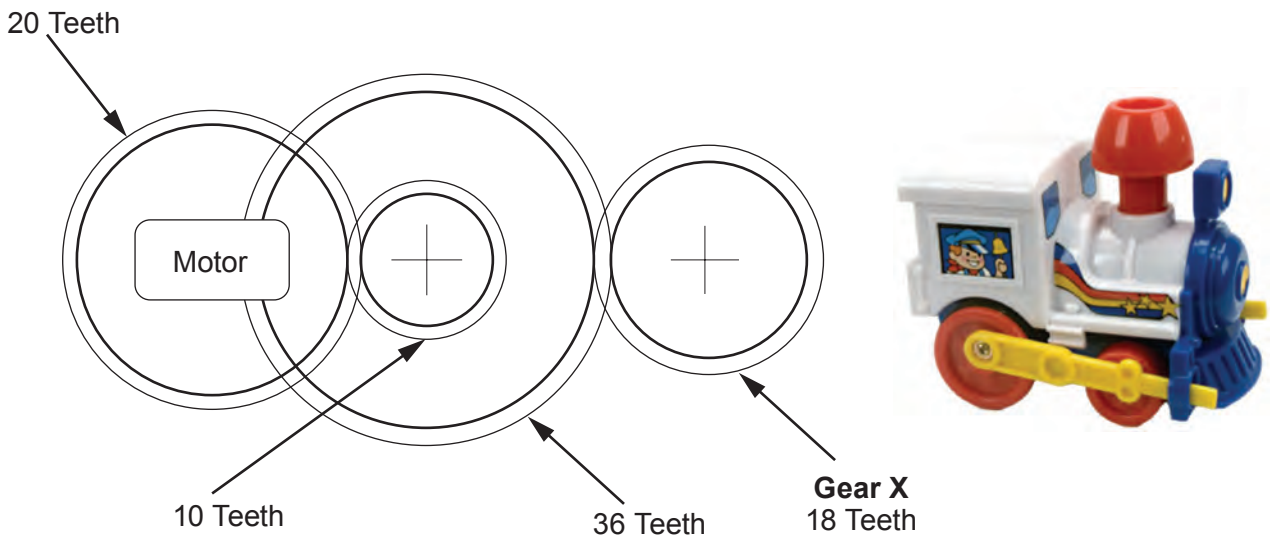
(i) **Circle** the correct name for this mechanism. [1]

- Pawl and ratchet** **Cam and follower** **Crank and slider**

(ii) Complete the statement below by adding the correct type of motion. [2]

This mechanism converts motion to motion.

(b) The gear system shown below is used to power a toy train.



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

Statement	True	False
The train uses a compound gear system.		
Gear X will go slower than the 36 Teeth Gear.		

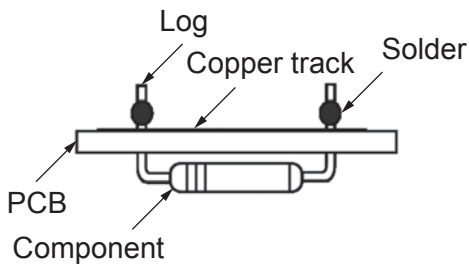
- (ii) Calculate the rotational velocity (RV) of **Gear X** when the motor rotates at 20rpm. (Show all your workings.) [3]

.....

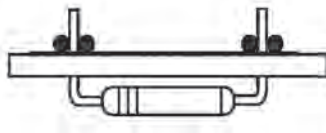
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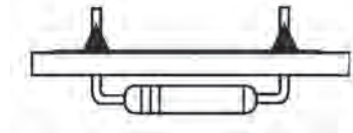
- (c) Components are soldered onto the PCB to construct circuits. Study the soldered joints below.



Soldered joint A



Soldered joint B






Soldered joint C

- (i) State which joint is soldered correctly: [1]
- (ii) Describe what has caused the solder to take the shape shown in joint A. [2]

.....

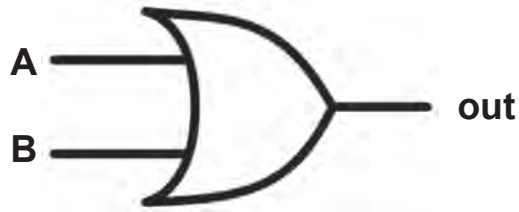
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- (d) Complete the table by sketching the correct symbol for **each** electronic component. [3]

(e) Complete the truth table for the logic gate shown.

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A	B	OUT
0	0	0
1	0	
0	1	
1	1	



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

(a) Select from the word bank below and complete the table by writing the correct name of the workshop tools shown. 3 × [1]

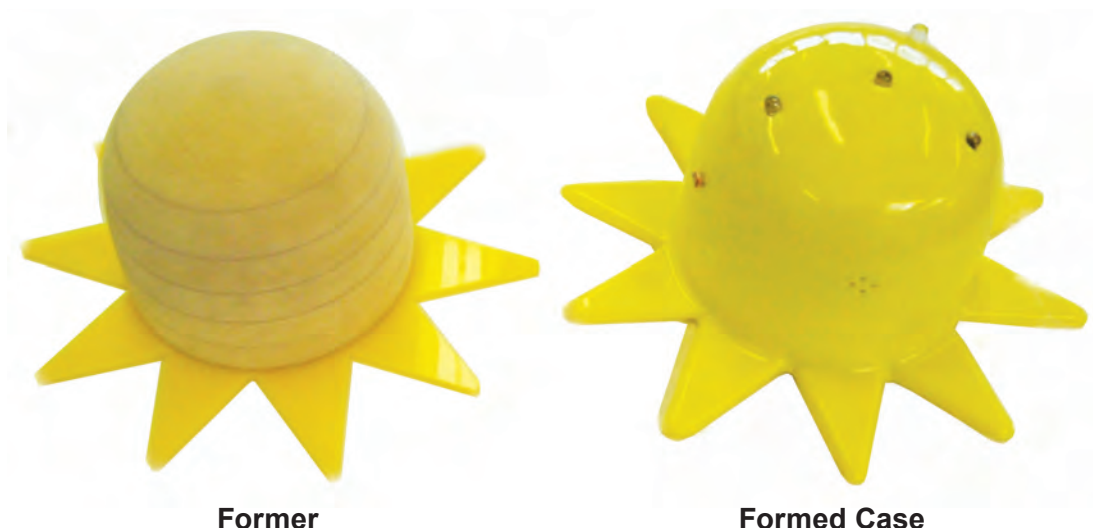
Pliers Power supply unit Soldering iron Breadboard Wire strippers Multimeter

		
<p>.....</p>	<p>.....</p>	<p>.....</p>

(b) Give the full meaning of the common symbols shown below which are found in school workshops. 2 × [1]

	
<p>Meaning:</p> <p>.....</p> <p>.....</p>	<p>Meaning:</p> <p>.....</p> <p>.....</p>

(c) A student has made a former to produce a vacuum formed case as shown below.



Former

Formed Case

(i) Name a suitable wooden material to make the former. [1]

(ii) The former is made from several layers and turned on a lathe. Complete the table below by describing **each** stage, naming all the tools and equipment used to prepare the layers ready to turn on the lathe. 3 × [1]

Stage No.	Activity	Description including all tools and equipment used.
One	Marking out
Two	Cutting
Three	Gluing

(iii) Name a specific plastic to make the base of the former using CAM. [1]

.....

(d) CAM machines require speed and power settings. Explain why these are necessary. [2]

.....

.....

(e) A student has designed a fuse tester with a light that illuminates if the fuse has not blown.



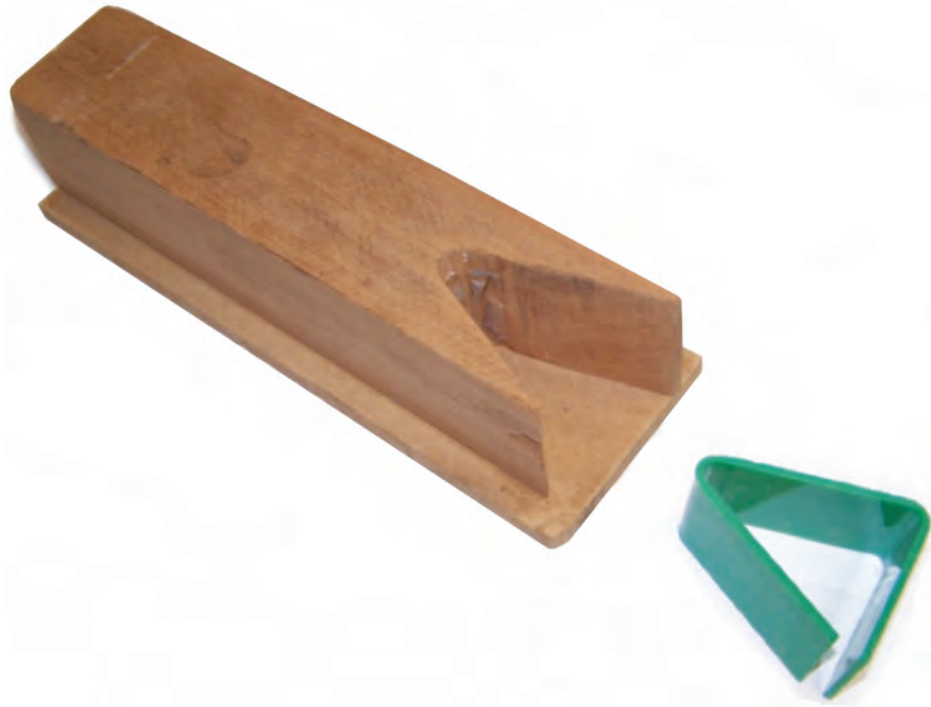
(i) Name **one** permanent method of fixing the printed circuit board (PCB) to the main body. [1]

.....

(ii) The battery wires need to be fitted so that they are not seen. Using notes and sketches explain how this could be achieved. [3]

<p>Sketches:</p> 	<p>Notes:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
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- (iii) The photograph below shows how the main body of the fuse testers will be made in volume using a jig.



Describe, in detail, **two** advantages of using the jig.

Advantage 1: [2]

.....

.....

Advantage 2: [2]

.....

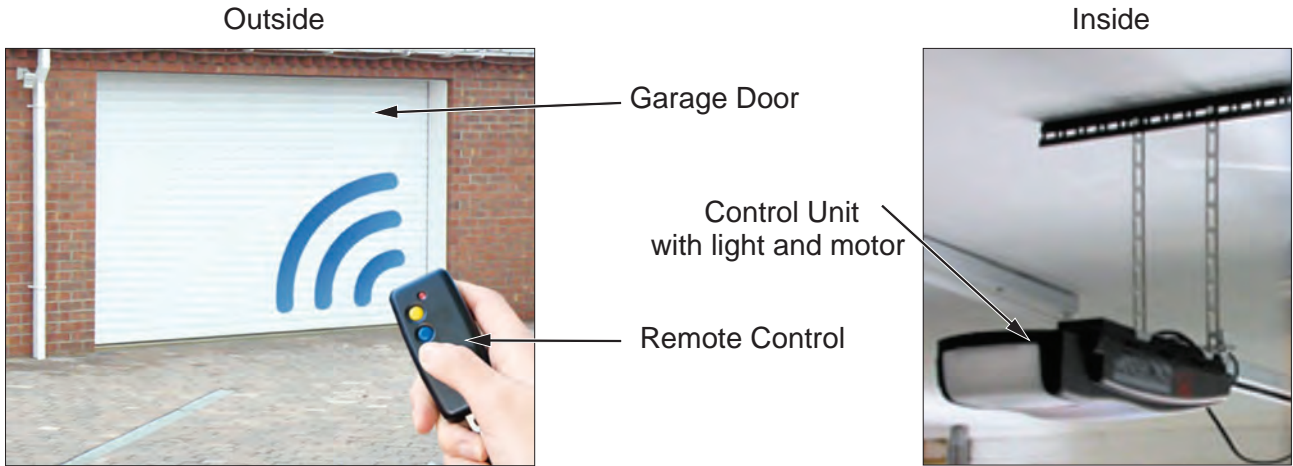
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Turn over for Question 8

8. This question is about ICT, CAD, CAM, Systems and Processes. It is worth a total of 15 marks.

(a) The remote controlled automatic garage door below operates when a remote control is used.



When the user presses the yellow button the garage door opens, when the blue button is pressed the door closes. During operation a courtesy light on the Control Unit inside the garage illuminates.

(i) Name **one** input to the garage door system. [1]

.....

(ii) Name **one** output to the garage door system. [1]

.....

(iii) Describe the reason for the courtesy light on the Control Unit. [2]

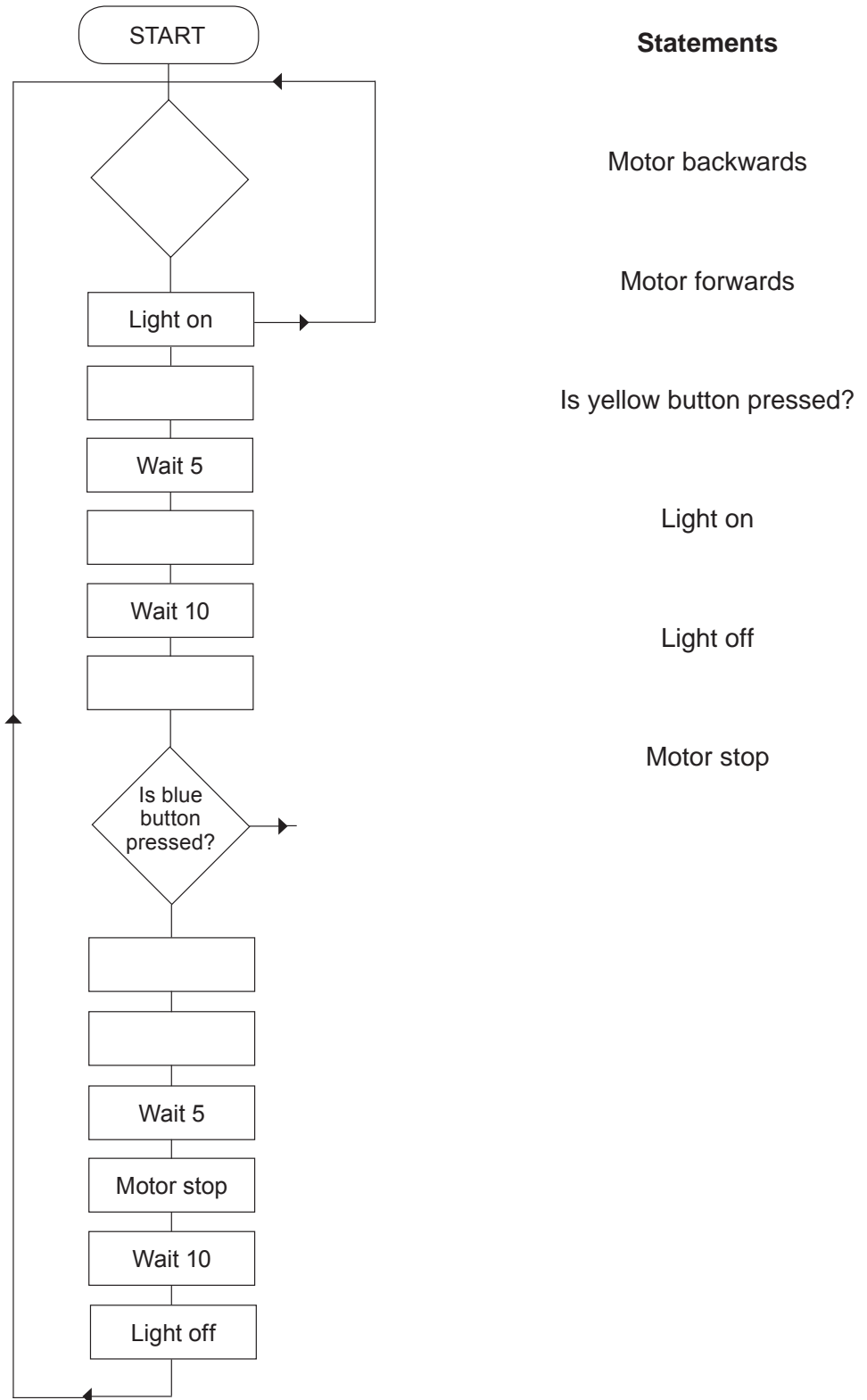
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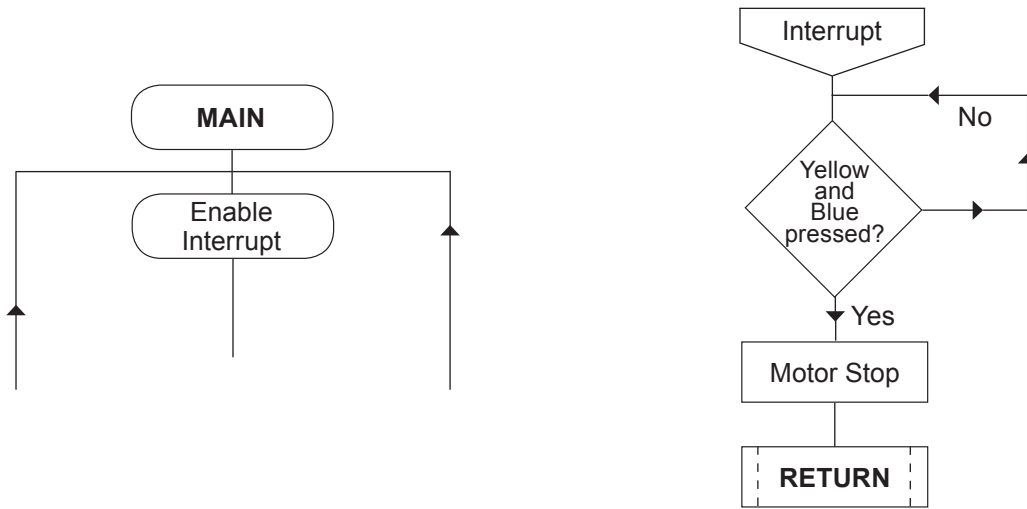
(b) The flowchart below shows how the garage door system is controlled.

Complete the flowchart by placing the statements in the correct positions and adding any missing feedback loops. [7]

Note: Motor forwards opens the door, assume the door is closed at the start.



(c) The flowchart could be modified to include an interrupt system.



Give **two** reasons why this interrupt needs to be added to the flowchart.

Reason 1: [2]

.....

Reason 2: [2]

.....

END OF PAPER

