Candidate Name	Centre Number	Candidate Number
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WJEC CBAC

GCSE

4121/01

DESIGN AND TECHNOLOGY

UNIT 1

FOCUS AREA: Systems and Control Technology

P.M. WEDNESDAY, 25 May 2011

2 hours

	Leave Blank
Question 1	
Question 2	
Question 3	
Question 4	
Question 5	
Question 6	
Question 7	
Question 8	
TOTAL MARK	

4121 010001

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.

INFORMATION FOR CANDIDATES

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

Examiner only

SECTION A

Marked out of 60 *60 minutes*

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

A set of bicycle lights have been launched to compete with other similar products.

Rear Light For Bicycle	***Front Light For Bicycle***
	

Features:

- three ultra bright LEDs;
- universal fitting;
- 2 x AA batteries;
- flashing or steady modes.

(a) A design specification was produced before designing the bicycle lights. Write a detailed specification point for each of the following headings.

(i) Function: ..... [2]

.....

(ii) Target Market: ..... [2]

.....

(iii) Safety: ..... [2]

.....

(b) State **two** considerations that will affect the size of the bicycle lights.

Consideration 1: ..... [1]

Consideration 2: ..... [1]

(c) The bicycle lights are made using mass production.

Explain why this is the most suitable scale of production. [2]

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(d) Explain how the style of the bicycle lights will appeal to customers. [2]

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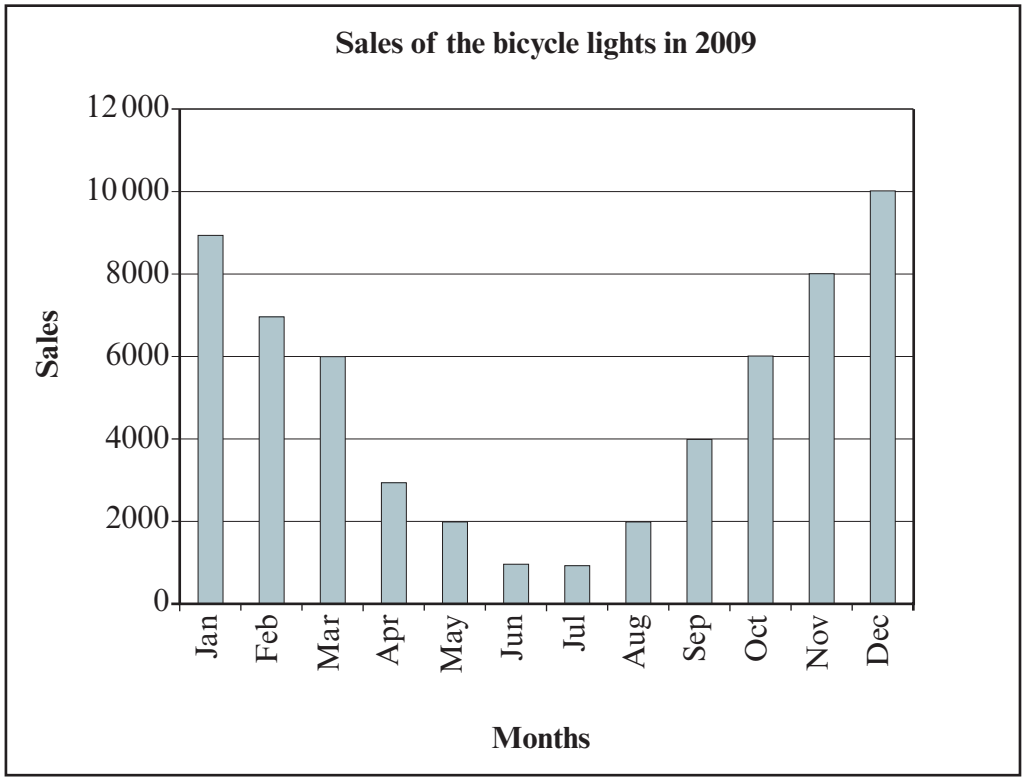
(e) The bar chart below shows the annual sales of the bicycle lights.



(i) State in which month 4000 were sold. [1]

.....

(ii) Calculate the average monthly sales for March, April and May. [2]
Show all your workings.

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Examiner only

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

(a) The logo shown below appears on many products and packaging for products.

State the meaning of this symbol. [1]

.....

(b) Study the information about a disposable camera shown below.

- Retails at £2.99.
- Black polystyrene case.
- Card cover.
- Built in flash.

(i) Describe how a disposable camera can have a negative effect on the environment. [2]

.....

.....

(ii) Describe how a disposable camera could be helpful for the environment. [2]

.....

.....

(c) Designers should consider the six Rs when problem solving. Complete the list below by adding the **two** missing Rs. [2]

Rethink

R.....

R.....

Repair

Reduce

Refuse

(d) Many electronic products use rechargeable batteries. Explain how these products can be considered more sustainable. [3]

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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 Jonathan Ive and Trevor Baylis.

(i) Write the name of the designer responsible for each of the products shown below. [2]

	
Designer:	Designer: .....

(ii) Select **one** of these designers and write a short essay describing their range of work and the impact it has had on Design and Technology. [8]

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

Name of designer: .....

.....

.....

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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 three design stages below and use a line to join them to the correct description. [3]

Design Stages	*Description*
Initial Ideas	Improving the best idea.
Development of ideas	Checking the outcome against the Specification.
Evaluation	A range of possible solutions.

(b) (i) Name **one** piece of CAD software that is useful when developing an electronic system. [1]

.....

(ii) Describe how this software helps when developing an electronic system. [3]

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Examiner only

(c) A hotel requires you to design an electronic DO NOT DISTURB door sign for residents to use to indicate that they wish to remain in their room without interruption.

Specification

The device must:

- be powered by a 9V battery;
- be easily switched on / off;
- include **two** LEDs that flash alternately;
- be able to be fitted to the hotel room door.

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 fits to the 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.

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

Examiner only

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) SMT is a technique where small components are placed onto printed circuit boards. Complete the meaning of SMT. [1]

S ..... M ..... Technology.

(b) Electronic products can be manufactured using automated machinery.

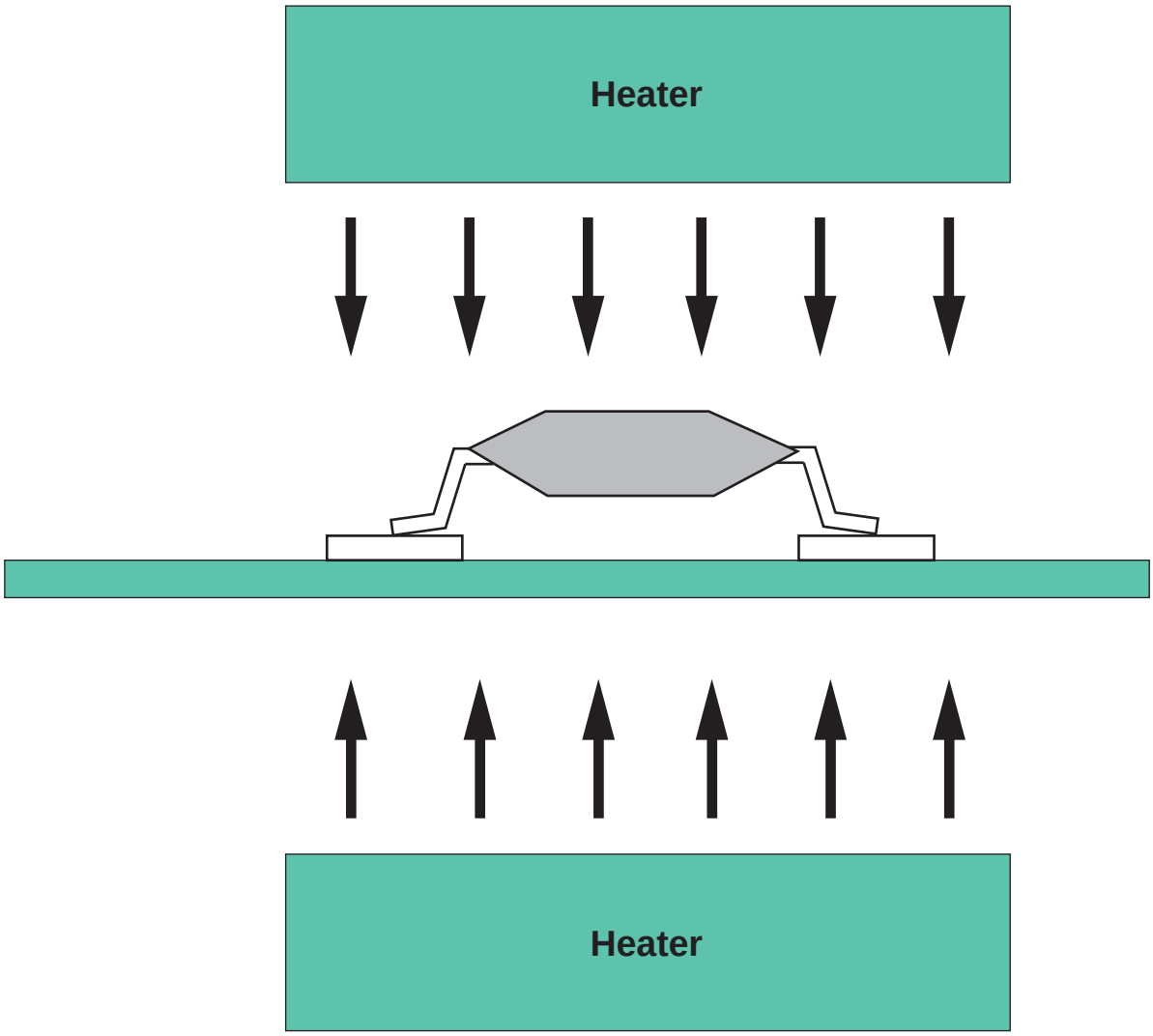
Complete the table by placing the stages from the list below in the correct order. [4]

Components soldered **Product is tested** **Product is packaged**

Components placed onto PCB

Order	***Stages***
1	Printed circuit board is made and checked.
2	
3	
4	
5	
6	Product is sent to retailer or consumer.

(c) The diagram below shows an electronic component being joined to a circuit board using the reflow soldering process.



(i) Explain how reflow soldering is used to construct electronic systems. [3]

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(ii) Describe **one** advantage to the manufacturer of using reflow soldering over through hole construction. [2]

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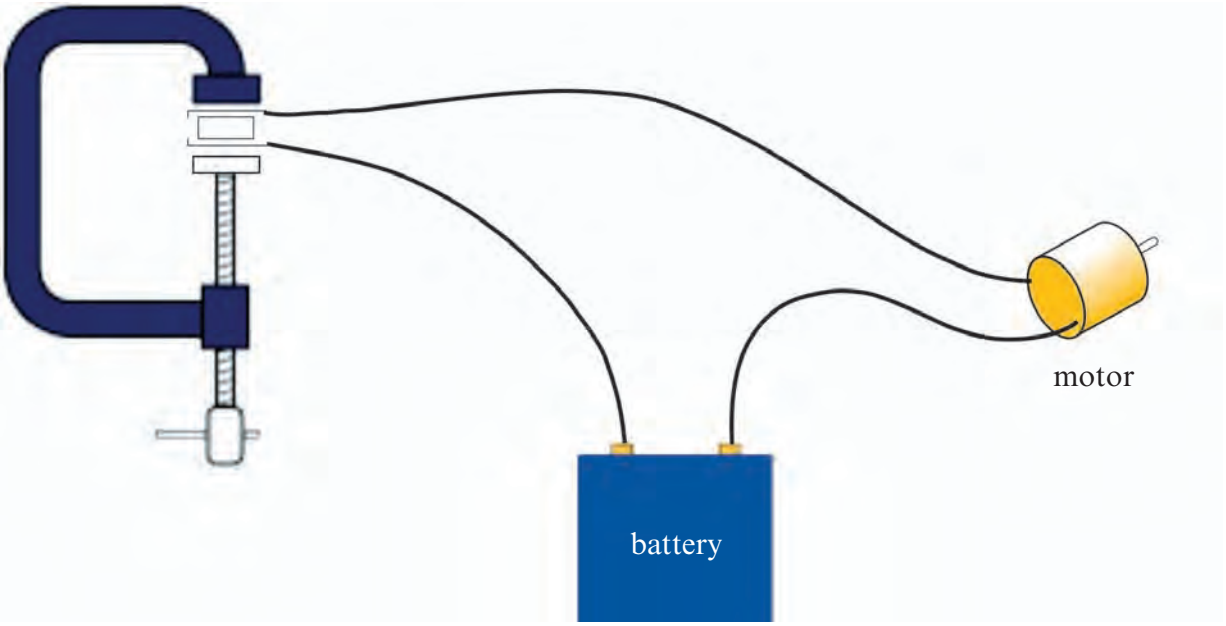
Examiner only

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

(a) Complete the table below by drawing the electronic symbol for each of the components shown. [4]

(b) The picture below shows a pill of Quantum Tunnelling Composite (QTC) being compressed using a G cramp.



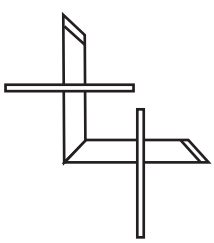
Complete the descriptions below of how the circuit works by circling the correct words in the statement. [2]

When the QTC pill is under low compression the motor will turn **quickly / slowly**.

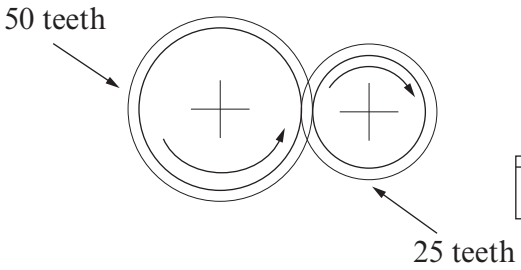
When compression on the QTC pill increases the motor will turn **faster / slower**.

Examiner only

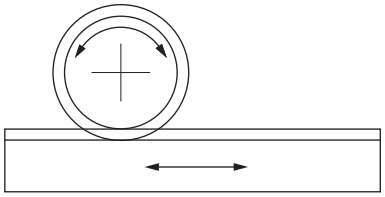
(c) Study the gear mechanisms below.



Bevel Gears



Spur Gears



Rack and Pinion

(i) State the name of the gear system that converts rotary motion at 90 degrees. [1]

.....

(ii) State the name of the gear system that converts rotary motion to linear motion. [1]

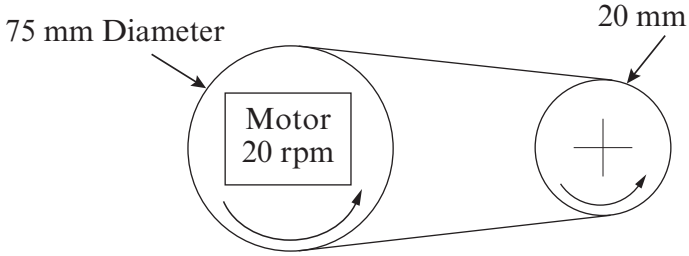
.....

(iii) State the velocity ratio (VR) of the spur gears. [1]

.....

(d) A toy helicopter like the one shown below has rotating blades powered by a pulley system.

Toy Helicopter



Calculate the rotational velocity (RV) of the driven pulley. [2]
Show all your workings.

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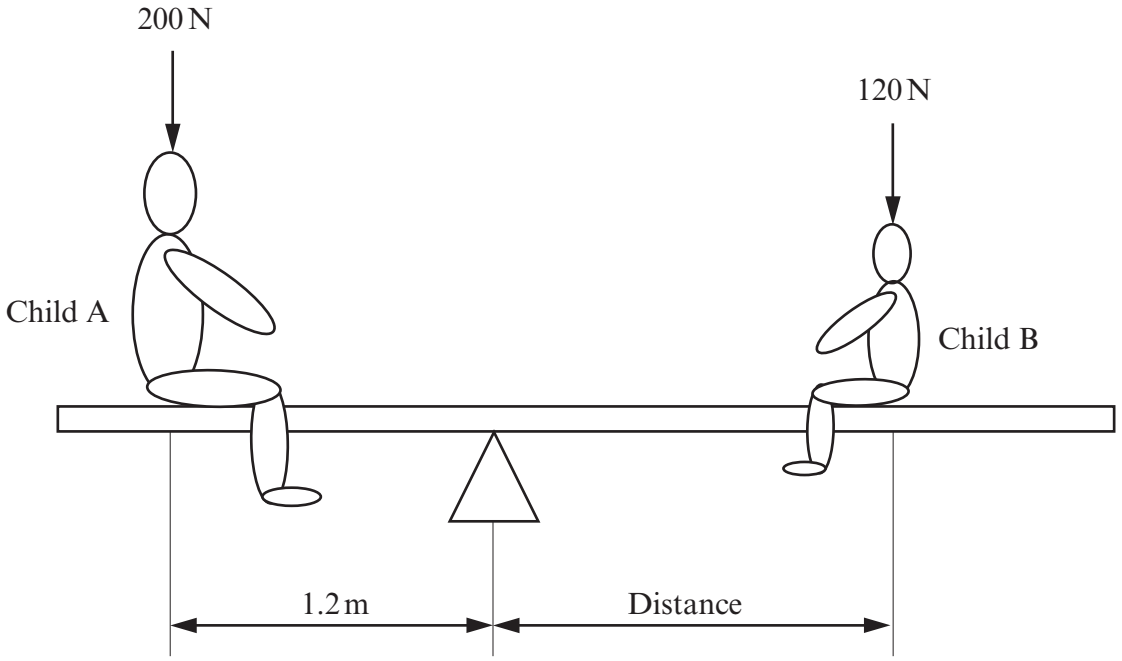
Examiner only

(e) The diagram shows two children playing on a see-saw.



(i) State the class of lever shown in the diagram. [1]

Class .....

(ii) Using the principle of moments, calculate the distance that child B is seated away from the fulcrum for the see saw to be balanced. [3]
Show all your workings.

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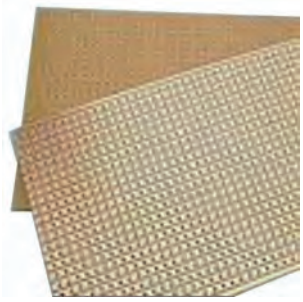
7. This question is about Tools, Equipment and Making. It is worth a total of 20 marks.

(a) Complete the table below by adding either the name or use for each of the items shown. [6]

	
Name: Electronics Kits	**Name**:
Use:	**Use**: To measure voltage, current or resistance in electronic circuits. To test or check for continuity.
	
Name: Stripboard	**Name**:
Use:	**Use**: To cut wires, cable and remove sleeving. Trimming wires or component legs after soldering.

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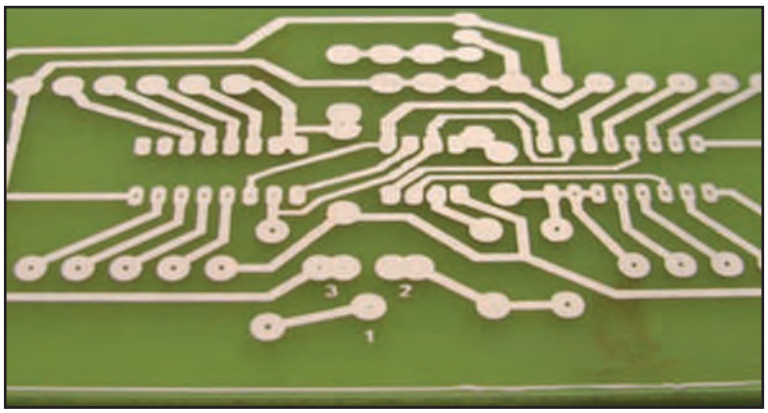
(b) The picture below shows a printed circuit board.

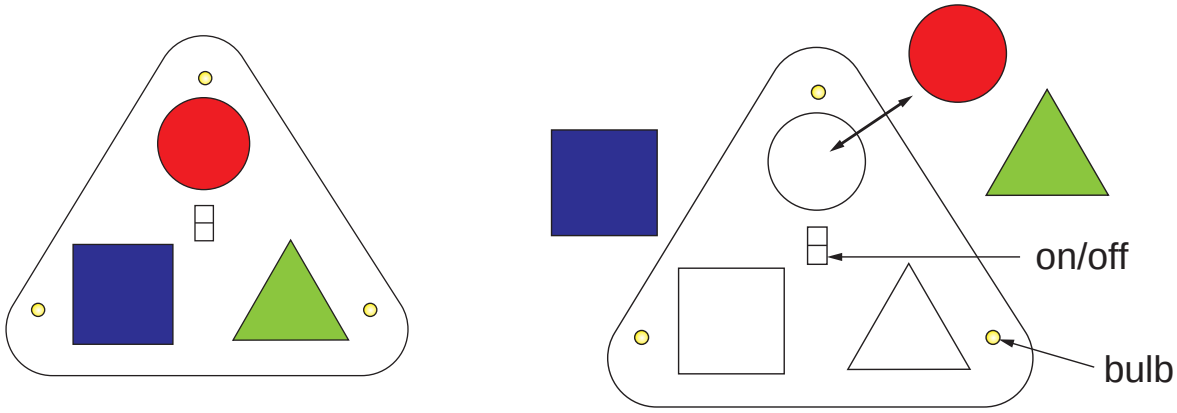


Describe the **four** main stages to make a printed circuit board in a school workshop. [4]

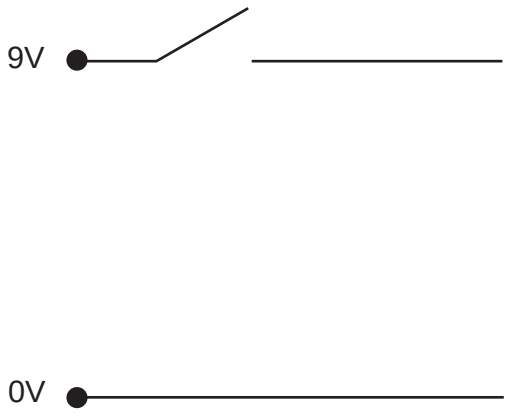
Stage	***Description***
One	....
Two	....
Three	....
Four	....

Examiner only

(c) A design for a simple puzzle for small children is shown below.
When the puzzle is complete the three bulbs will come on together.



In the space below, complete the electronic circuit design for the puzzle. [3]



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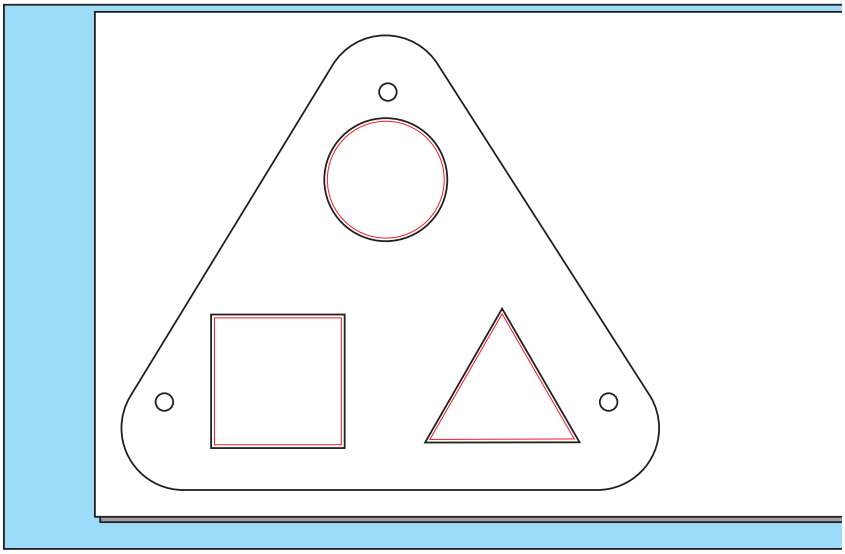
(d) (i) CAM is used to cut the puzzle base and pieces. State the meaning of CAM. [1]

C..... A..... M.....

The drawing below is used for a Cam routing machine (CAMM2) to cut out the top of the puzzle.



(ii) State the reason for the red lines on the drawing. [2]

.....

.....

(iii) Using notes and sketches describe how you would accurately fit the on/off switch shown below to the puzzle. [4]

Notes: .....

.....

.....

.....

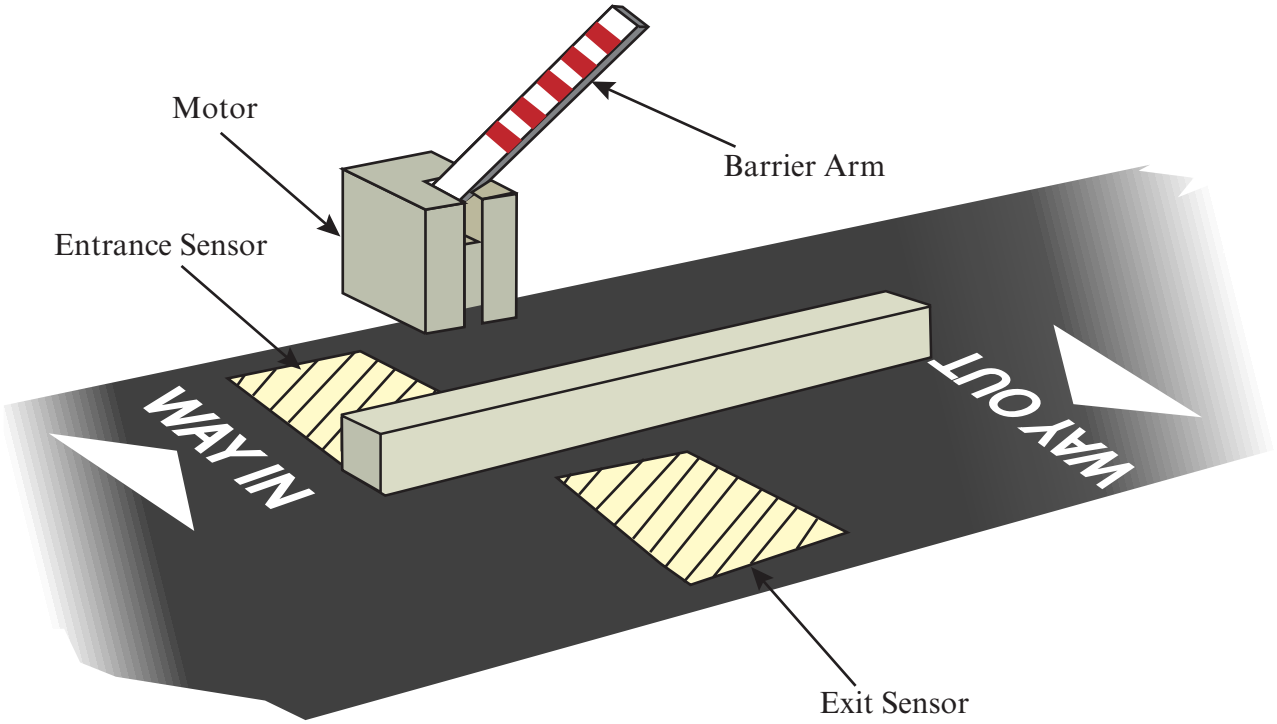
.....

Sketches

Examiner only

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

(a) The barrier system below controls entry to a car park with 10 car parking spaces.



(i) Name **one** input to the car park barrier system. [1]

.....

(ii) Name **one** output to the car park barrier system. [1]

.....

(iii) Describe the role of the exit sensor. [2]

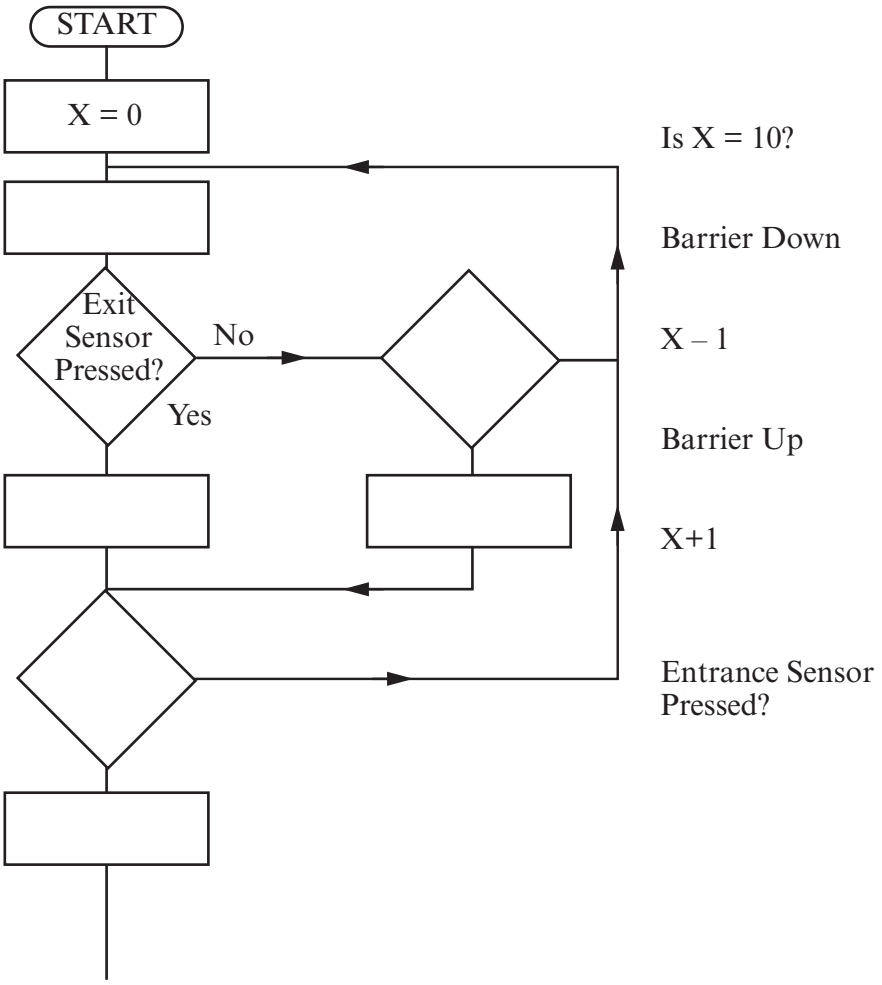
.....

.....

Examiner only

(iv) The car park has 10 spaces. The barrier arm stays up and allows cars to enter unless the car park is full. The barrier arm then drops down and stays down until a car leaves.

Using the statements complete the flowchart below and draw in the missing feed back loop to control the car park barrier.
(Note: X represents the number of cars.) [7]



(b) Explain **two** advantages of using a Programmable Interface Controller (PIC) to control the car park barrier.

Advantage 1: .....

.....

[2]

Advantage 2: .....

.....

[2]

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For continuation only