

Surname	Centre Number	Candidate Number
Other Names		0

**GCSE**

4121/01

DESIGN & TECHNOLOGY**UNIT 1****FOCUS AREA: Systems and Control Technology**

A.M. FRIDAY, 25 May 2012

2 hours

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

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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.

SECTION A

Marked out of 60 60 minutes

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

A solar mobile phone charger was launched to compete with other products.



Features:

- Under sun light, the charger can generate 6V, 0.1A.
- Can connect to most mobile phones.
- Radio and flashlight functions included.
- Small compact design (100mm × 30mm × 12mm).
- Lightweight (50g).

(a) A design specification was produced before designing the solar charger.

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

(i) Function: [2]

.....

(ii) Target Market: [2]

.....

(iii) Style: [2]

.....

(b) The manufacturer is considering releasing the solar charger in a range of colours. Give **two** reasons why you think they would want to do this.

(i) Reason 1: [1]

(ii) Reason 2: [1]

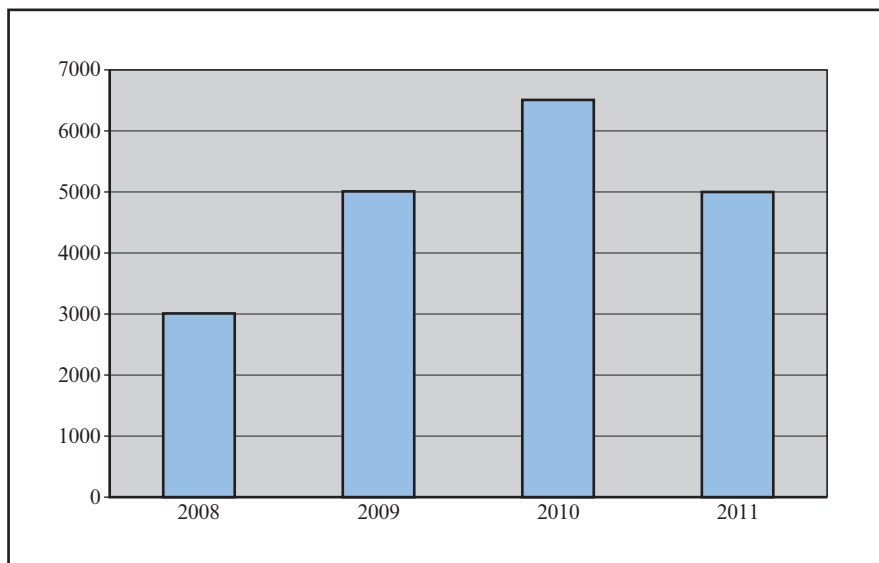
(c) The solar charger is made using mass production.

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

(d) The casing for the solar charger is made using injection moulding.

Describe why this is a suitable manufacturing process for the solar charger casing. [2]

(e) The bar chart below shows the sales of the solar charger for four years.



(i) State the total sales of the solar charger from 2008 to 2011. [1]

(ii) Calculate the average annual sales for the solar charger. [2]
Show all your workings.

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

(a) Complete the table below by matching the correct 'R' to each of the descriptions. (*One example has been done for you.*) [5]

Reuse Recycle ~~Rethink~~ Refuse Reduce Repair

Take a waste product and use the material or parts for another use.	
Do not buy a product if you do not need it.	
Minimise the amount of energy you use.	
Ask whether we can sustain our current way of life.	Rethink
When a product breaks try to fix it.	
Reprocess a waste material to use in another product.	

(b) Many people are now using light bulbs like the ones shown below.



Give **one** reason why these bulbs are now more common. [2]

.....

.....

(c) The picture below shows a wind farm.



Explain how the development of wind farms can create winners and losers. [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 stages in the design process given below and complete the table by placing the correct stage next to **each** description. [3]

Evaluation Development Planning Modelling Specification

<i>Stages</i>	<i>Description</i>
.....	A list of features that the product must include.
.....	Using card to make a mock-up of what the product could look like.
.....	To consider the time available and the tasks to be completed.

- (b) (i) Name **one** way designers can find out what customers want in a product. [1]

.....

- (ii) Give **three** reasons why products are often disassembled and analysed by designers. [3]

Reason 1:

.....

Reason 2:

.....

Reason 3:

.....

- (c) You are required to design a light tester for a cricket umpire to detect when to stop a cricket match due to poor light conditions.

Specification

The device must:

- be powered by a 9V battery and easily switched on/off;
- show a green light when switched on;
- include a buzzer to sound when it is too dark to play cricket;
- be able to be carried by the umpire.

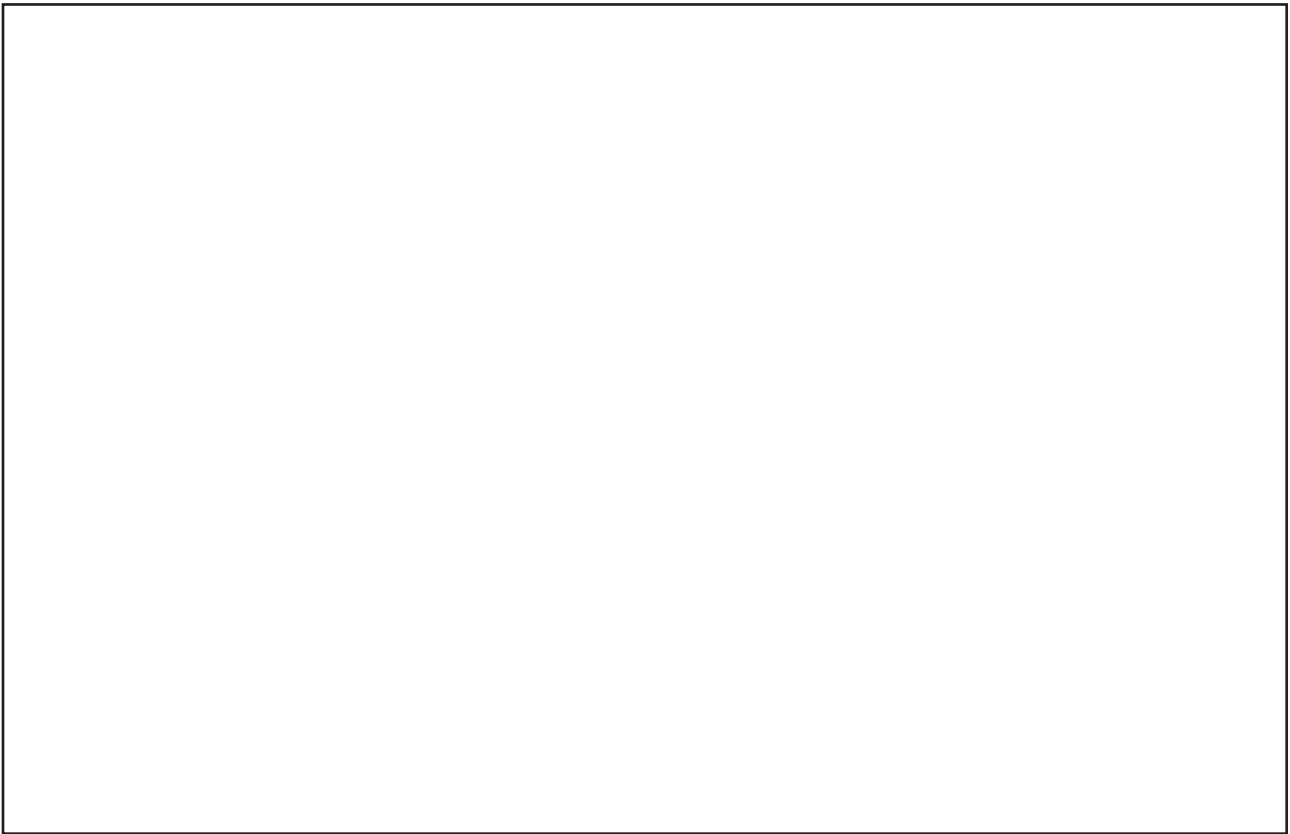


Marks will be awarded for:

- | | |
|---|-----|
| (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 carried by the umpire; | [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.

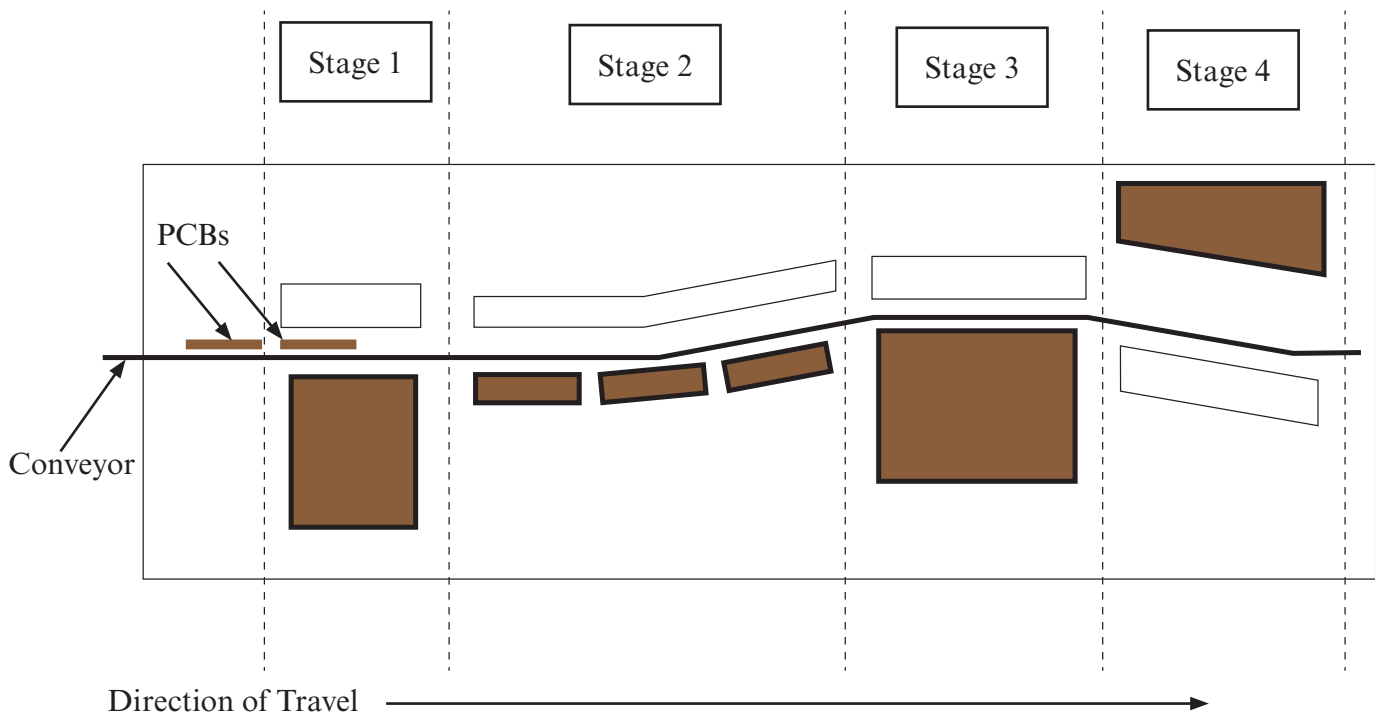


SECTION B

Marked out of 60 60 minutes

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

(a) The diagram shows the side view of a wave soldering machine.



(i) Using the names in the word bank below, complete the table by placing the correct name under **each** stage. [4]

Cooling Solder Wave Pre Heating Fluxing

<i>Stage 1</i>	<i>Stage 2</i>	<i>Stage 3</i>	<i>Stage 4</i>

(ii) Wave soldering is a faster process than using manual soldering. Describe another advantage of using wave soldering over manual soldering. [2]

.....

(b) Quality control is important when manufacturing commercial products. Explain what you understand by the term *quality control*. [2]

.....

.....

(c) Explain why electronic products are often designed in one country but manufactured in another country. [2]

.....


.....

.....

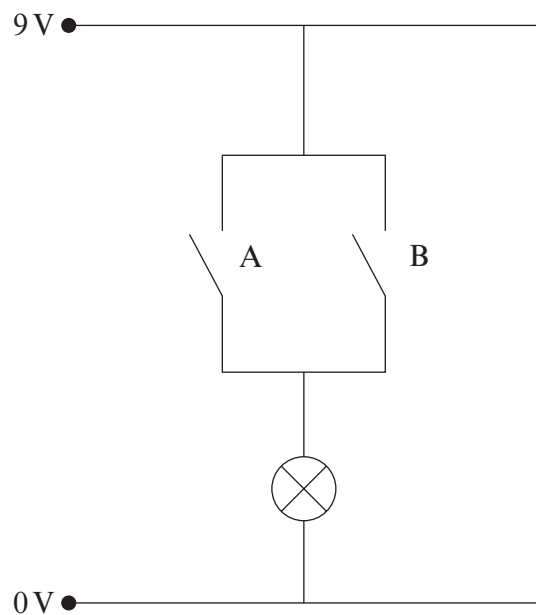
6. This question is about Materials and Components. It is worth a total of 15 marks.

- (a) Complete the table below by drawing the electronic circuit symbol for **each** of the components named. [3]

An example has been done for you.

<i>Bulb</i>	<i>Capacitor</i>	<i>Light Emitting Diode (LED)</i>	<i>Relay Switch</i>
			

- (b) Study the electronic circuit below.



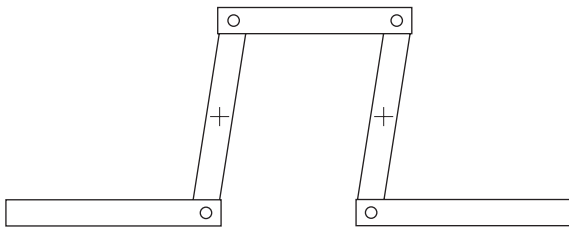
- (i) Complete the table to show whether the bulb is on or off. [3]

<i>A</i>	<i>B</i>	<i>Bulb</i>
Open	Open	off
Closed	Open	
Open	Closed	
Closed	Closed	

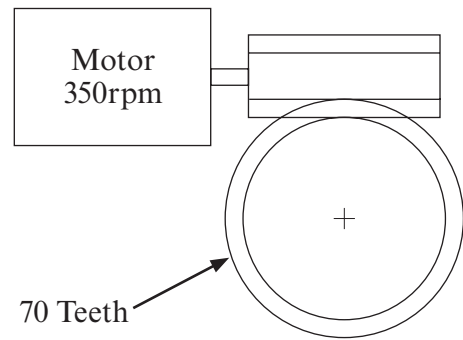
- (ii) **Circle** the correct word to complete the following statement. [1]

The switches in the circuit are arranged in **series** or **parallel**.

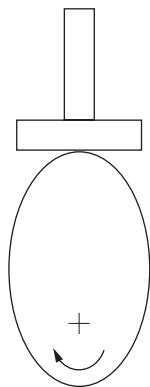
(c) Study the mechanisms shown below.



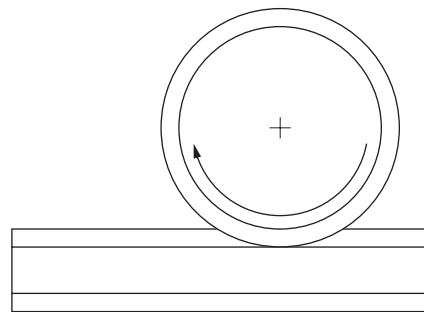
Linkage



Worm and Spur



Cam and Follower



Rack and Pinion

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

.....

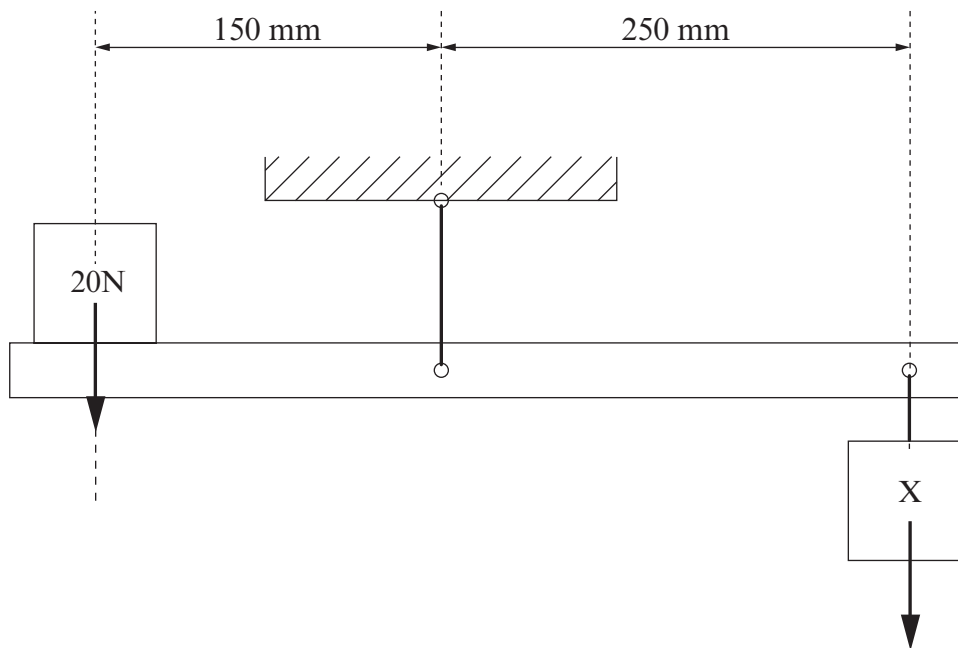
(ii) State the names of the **two** mechanisms that convert rotary motion to linear motion. [2]

..... and

(iii) State the velocity ratio (VR) of the spur gear in the worm drive system. [2]
Show all your workings.

.....

(d) The diagram shows a balance hanging in equilibrium.



Using the principle of moments, calculate the force of object X.
Show all your workings.

[3]

.....

.....

.....

.....

7. This question is about Tools, Equipment and Making. It is worth a total of 20 marks.
A student has used a mould to manufacture the buggy shown below.



- (a) (i) Name a suitable wood material to make the main body of the mould. [1]

.....

- (ii) Name a suitable plastic material and the process used to make the shell of the buggy. [2]

Material: Process:

- (iii) The four wheel arches on the mould are made from acrylic using CAM. Explain why CAM has been used to make the wheel arches. [2]

.....

.....

- (iv) Explain **two** important features the mould must have to be successful.

Feature 1: [2]

.....

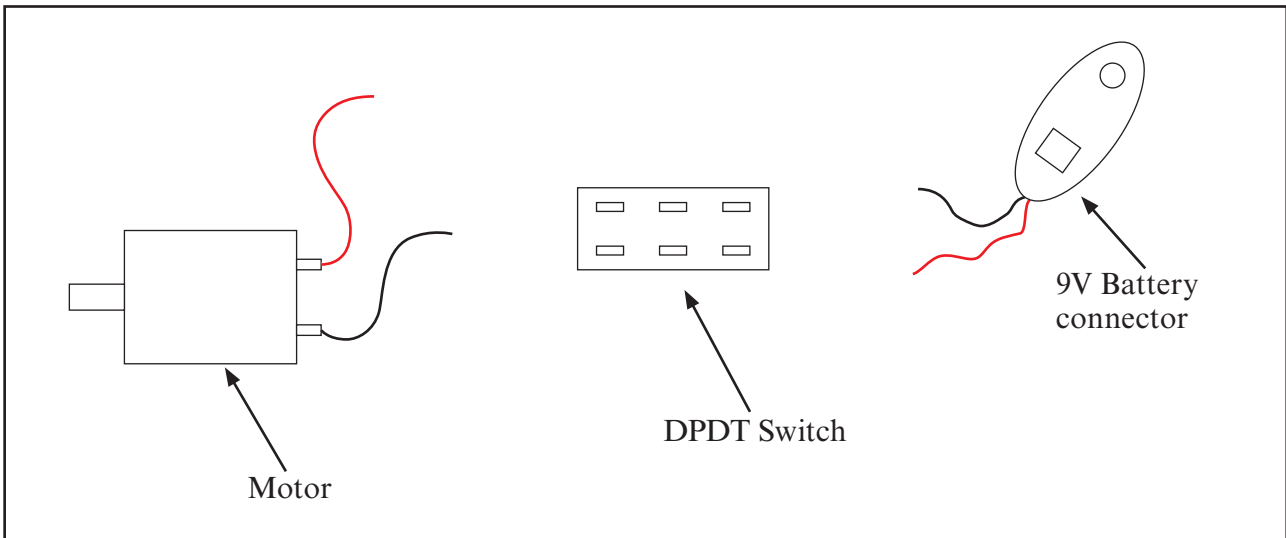
.....

Feature 2: [2]

.....

.....

- (b) (i) A double pole double throw (DPDT) slide switch is used to allow the buggy to move forwards and backwards. Complete the plan below by showing how you correctly wire the components and the switch to make the buggie move as required. [6]



- (ii) After soldering the system the motor will not turn. Explain in detail how you would find the fault in the system. [2]

.....

.....

.....

- (c) Describe, in detail, how you could make **two** different sized pulleys in a school workshop to allow the axle to be driven by the motor. [3]

.....

.....

.....

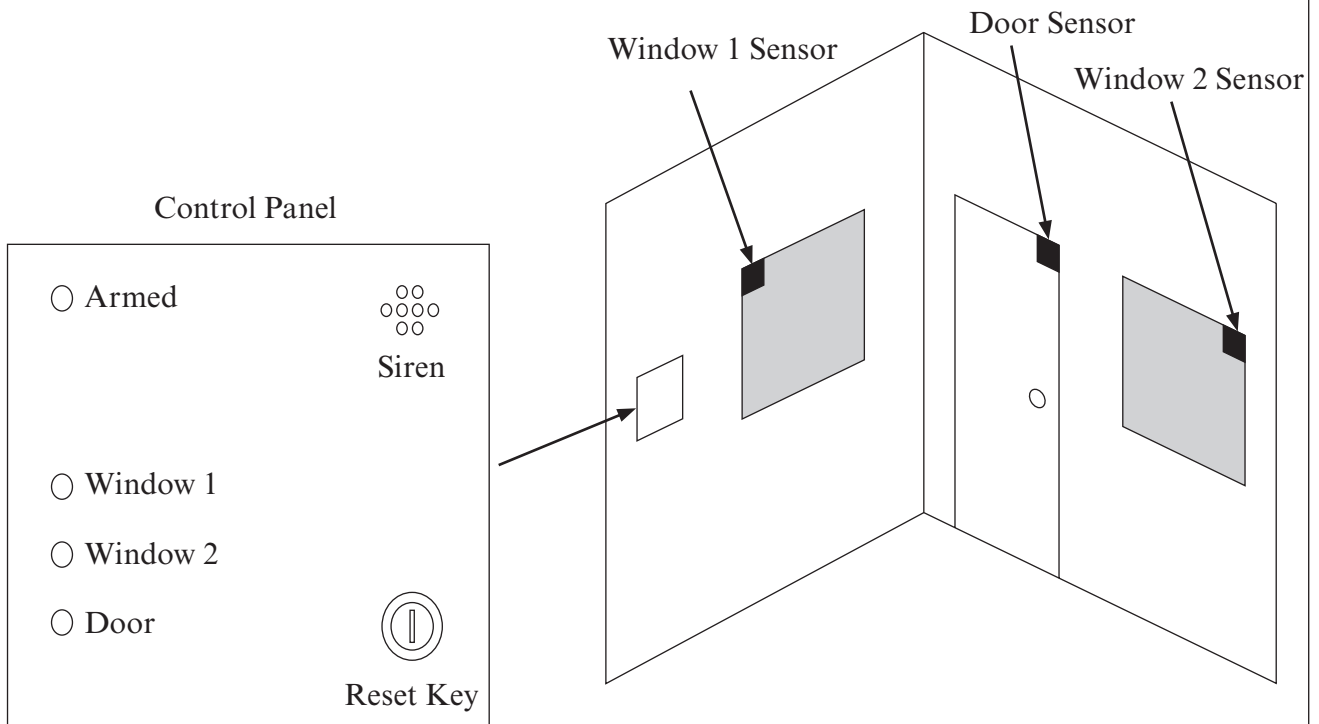
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8. This question is about ICT, CAD, CAM, Systems and Processes. It is worth a total of 15 marks.

(a) A home security alarm protects against intruders entering through the Door, Window 1 or Window 2.

The control panel indicates when the alarm is armed, and sounds a siren when triggered. The control panel shows the point of entry. The system is disarmed using a reset key.



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

.....

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

.....

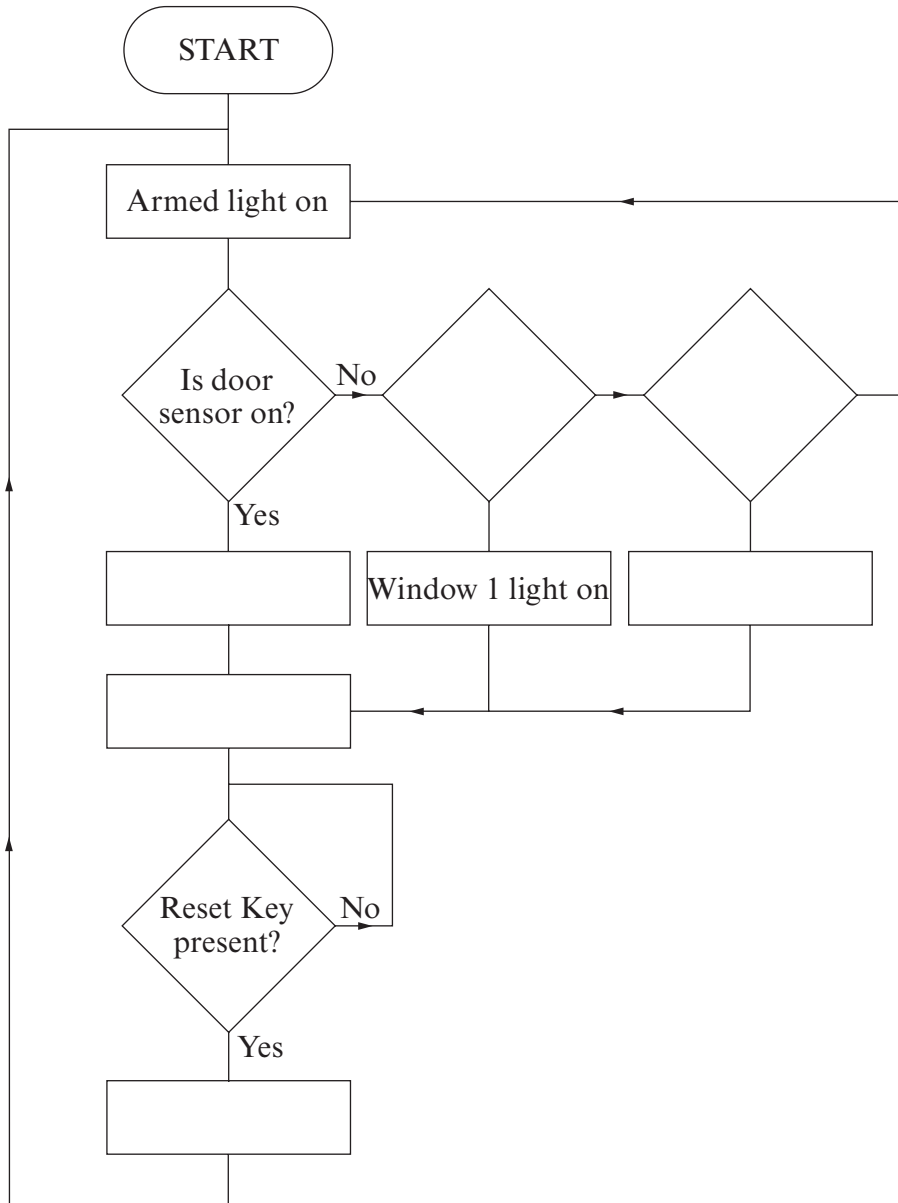
(iii) Describe the role of the door sensor. [2]

.....

.....

(b) The flowchart below is used to control the alarm system.

(i) Complete the flowchart by placing the statements in the correct positions. [6]



Statements

Is Window 1 sensor on?

All off

Siren on

Window 2 light on

Door light on

Is Window 2 sensor on?

(ii) Describe why a Programmable Interface Controller (PIC) would be a suitable component to control the alarm system. [2]

.....

.....

- (c) Using the table below, describe the **three** main stages of programming a PIC to be used in this alarm system. [3]

<i>Stage 1</i>
<i>Stage 2</i>
<i>Stage 3</i>

