Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						1	9	7	4	/	2	H	Signature	

Paper Reference(s)

1974/2H

Edexcel GCSE

Design and Technology: Systems & Control Technology (Electronics)

(Full Course – 1974)

Paper 2H

Higher Tier

Thursday 18 June 2009 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Some questions must be answered with a cross in a box (☒).
If you change your mind about an answer, put a line through the box (~~☒~~) and then mark your new answer with a cross (☒).

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 4 questions in this question paper. The total mark for this paper is 88.
There are 16 pages in this question paper. Any blank pages are indicated.
You may use drawing equipment. If pencil is used for diagrams/sketches it must be dark (HB or B).
Coloured pens, pencils and highlighter pens must not be used.
All measurements are in millimetres (mm) unless otherwise stated.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.
Include diagrams in your answers where these are helpful.

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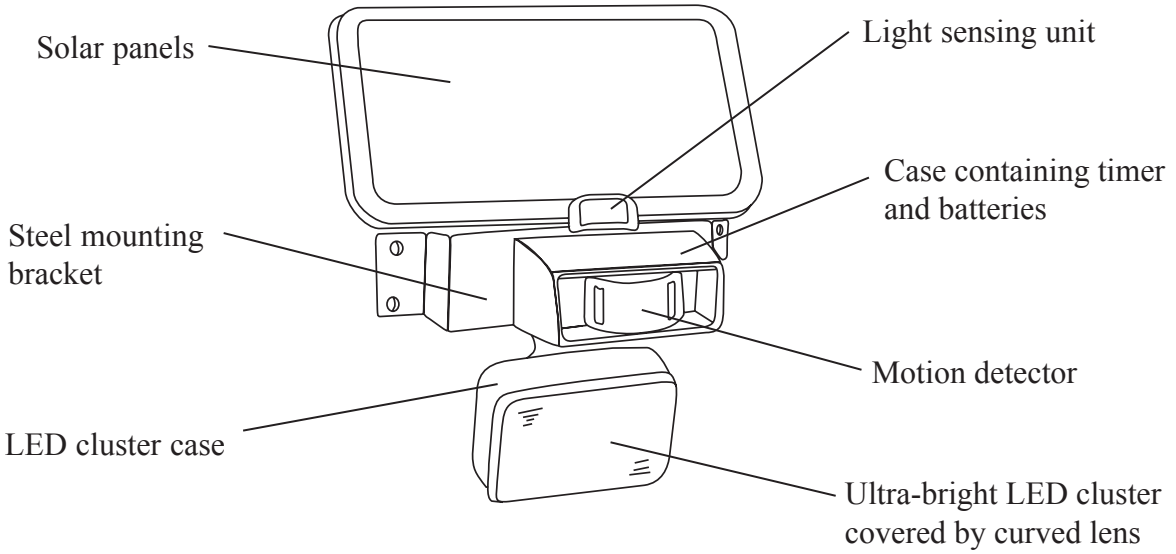
Answer ALL the questions. Write your answers in the spaces provided.

1. The drawing below shows details of a solar powered security light.



(a) Two specification points for the solar powered security light are that it must:

- light a large area
- be powered without mains electricity.

Under each of the following headings, give **one** more point that should be included in the specification for the solar powered security light.

For each point, give **one** reason why it should be included.

(i) The needs of the user.

Point .....

Reason .....

.....

.....

(2)

(ii) Environmental considerations.

Point .....

Reason .....

.....

.....

(2)

Leave blank

(iii) Quality.

Point .....

Reason .....

.....

.....

(2)

(b) The mounting bracket is made from steel.
One reason for using steel is that it can be bent to shape.

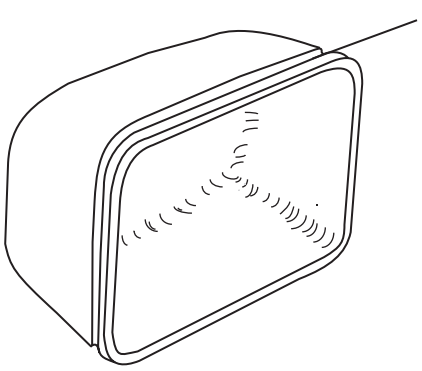
Give **two** other reasons why steel is a suitable material from which to make the mounting bracket for the solar powered security light.

1 .....

2 .....

(2)

(c) The ultra-bright LED cluster case is shown below. It is manufactured using injection moulding.



Cover not shown

Give **two** reasons why injection moulding is a suitable process for manufacturing the ultra-bright LED cluster case.

1 .....

2 .....

(2)

Leave blank

(d) The connections between the solar panels and the batteries of the security light are made from copper.

Give **two** properties of copper that make it suitable for the connections between the solar panels and the batteries.

For each property give **one** reason why it makes copper suitable for the connections between the solar panels and the batteries.

Property 1 .....

Reason .....

Property 2 .....

Reason .....

(4)

(e) Quality control checks are carried out at important stages during the manufacture of the solar powered security light.

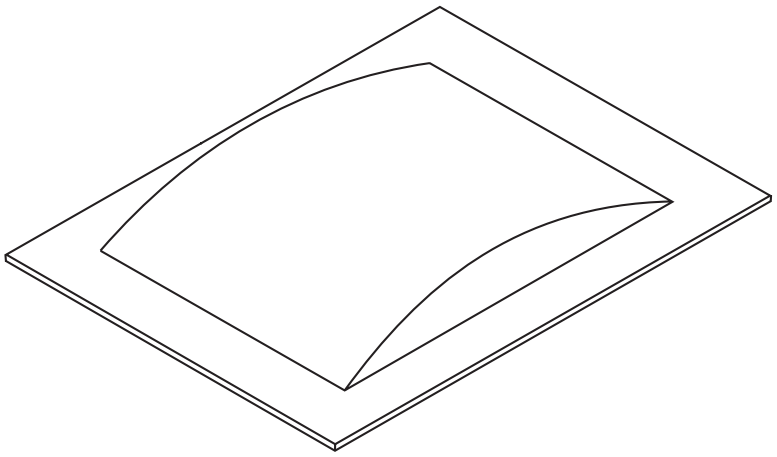
Name **two** important electronic quality control checks, other than safety, that should be made during the manufacture of the solar powered security light.

1 .....

2 .....

(2)

(f) The thermoplastic cover for the motion detector is shown below. It is made in batches using the vacuum forming process.



Describe **one** way in which the shape of the thermoplastic cover for the motion detector makes it suitable to be made in batches using the vaccum forming process.

.....

.....

(2)

Leave blank

(g) Two purposes of the solar powered security light are that it must:

- light a large area
- be powered without mains electricity.

Explain, under the following headings, how the solar powered security light achieves these purposes.

(i) Lights a large area.

.....

.....

.....

(2)

(ii) Be powered without mains electricity.

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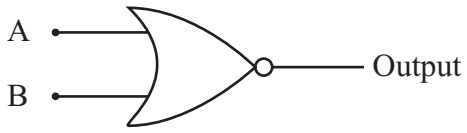
(2)

Q1

(Total 22 marks)

Leave blank

2. (a) The logic diagram of a NOR gate is shown below.



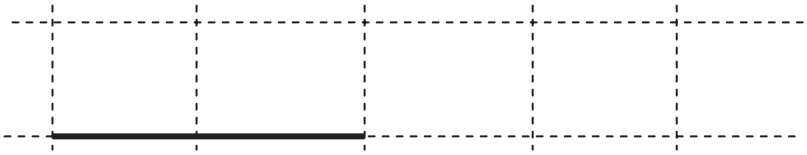
(i) Complete the truth table for the NOR gate. The first and last lines have been done for you.

Input A	Input B	Output
0	**0**	**1**
0	**1**	
1	**0**	
1	**1**	**0**

(2)

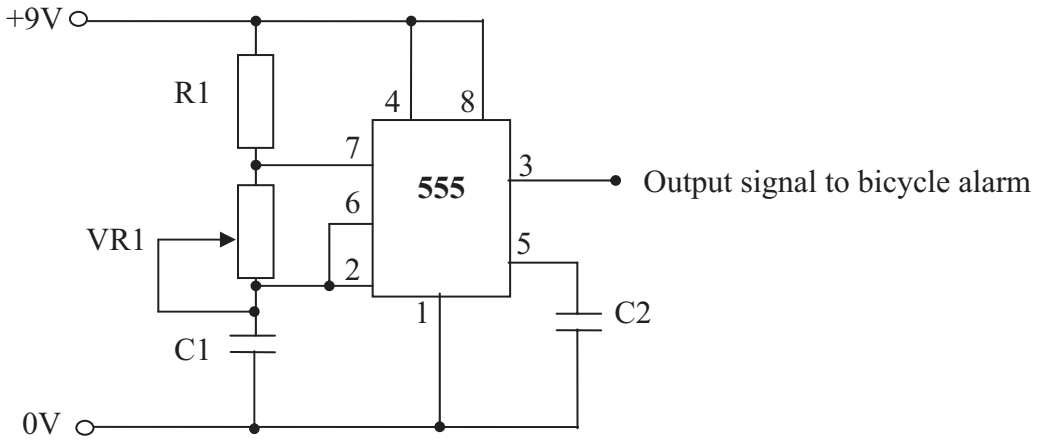
(ii) The NOR gate needs digital signal inputs.

Complete the graph of input A below.



(2)

(b) Part of a bicycle alarm circuit is shown below.
A 555 Astable is used to generate the pulses for the bicycle alarm circuit.



(i) Name the **three** components that control the frequency of the output signal.

1 .....

2 .....

3 .....

(3)

Leave blank

(ii) Describe **one** way in which the frequency of the output signal can be adjusted.

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.....

(2)

(c) A prototype Printed Circuit Board (PCB) for the bicycle alarm needs to be designed.

CAD can be used when designing a prototype PCB.

Describe **one** way that CAD can be used when designing a prototype PCB.

.....

.....

(2)

(d) A prototype of the bicycle alarm PCB is made before it goes into production.

Give **three** reasons for making a prototype of the bicycle alarm PCB before it goes into production.

1 .....

2 .....

3 .....

(3)

(e) CAD/CAM is used to ensure that all PCBs made in a batch are identical.

Describe **one** way that using CAD/CAM ensures that all the PCBs for the bicycle alarm are identical.

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(2)

(f) PCBs that are manufactured in batches are usually computer tested.

Give **two** reasons for using computers to test batch produced PCBs.

1 .....

2 .....

(2)

Leave blank

(g) PCBs are often designed and manufactured in different places.

Describe **one** way in which PCB designs can be sent electronically from the designer to the manufacturer.

.....

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(2)

(h) EPOS tills are used to gather sales information.

Explain **one** way in which sales information from EPOS tills can be used by manufacturers to help with future production planning.

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(2)

Q2

(Total 22 marks)

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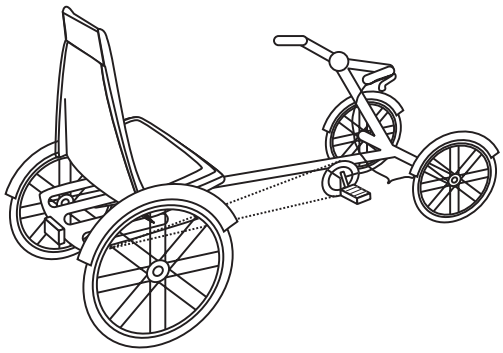
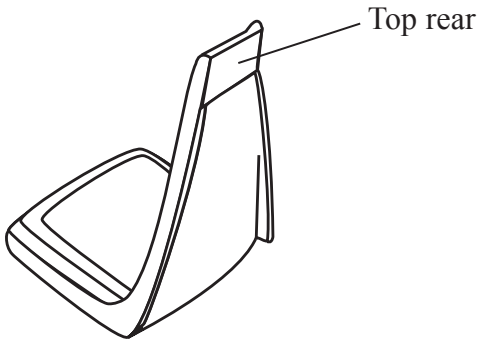
3. A company manufactures pedal carts for use on roads.





Pedal cart seat

The pedal cart is low to the ground and is not easily seen by other road users. This is especially true when it is dark or weather conditions are poor.

The company needs to design a safety device to warn other road users of the presence of the pedal cart.

The specification for the safety device is that:

- it must fix securely to the top rear of the seat
- it must include a visual warning signal that switches on when the seat is occupied
- it must include a method of sensing poor weather and make the warning signal more noticeable
- its case must be made using materials and processes suitable for batch production.

(a) In the spaces opposite, use sketches and, where necessary, brief notes to show **two different** design ideas for the safety device which meet this specification.

Do **not** show electrical/electronic connections in your designs.

Do **not** evaluate your designs in part (a).

Candidates are reminded that if pencil is used for diagrams/sketches, it must be dark (HB or B). Coloured pens, pencils and highlighter pens must **not** be used.

PLEASE DO NOT WRITE OR DRAW IN THIS SPACE.

PLEASE USE THE SPACES OPPOSITE FOR YOUR DESIGNS.

Leave blank

Design Idea 1

(8)

Design Idea 2

(8)

Leave blank

(b) Three of the original specification points are repeated below.

Evaluate how **one** of your design ideas succeeds or fails to meet each of these specification points.

Write down the number of your chosen design idea (1 or 2) here: .....

(i) The safety device must include a visual warning signal that switches on when the seat is occupied.

.....

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.....

(2)

(ii) The safety device must have a method of sensing poor weather and make the warning signal more noticeable.

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(2)

(iii) The safety device's case must be made using materials and processes suitable for batch production.

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(2)

Q3

(Total 22 marks)

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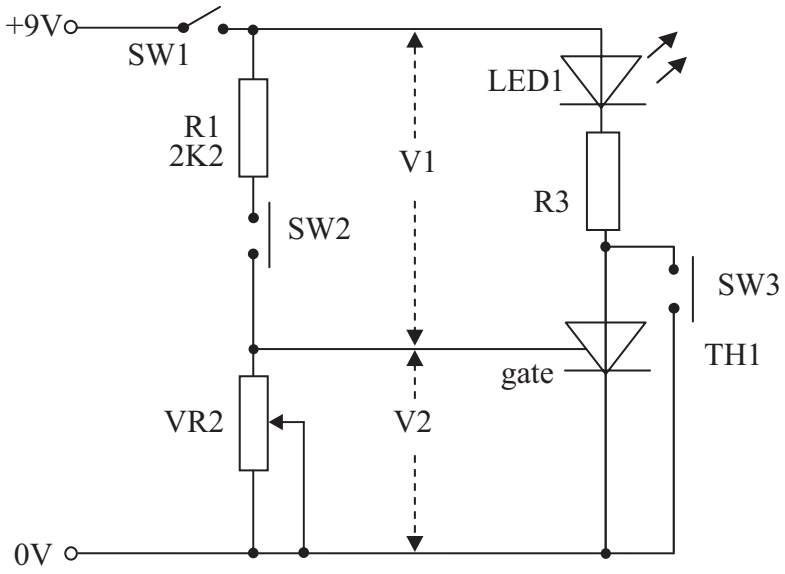
4. (a) A circuit diagram for a simple latch indicator is shown below.



Switch SW1 is closed to turn on the circuit.

(i) Describe the action of the thyristor (TH1) in the circuit when SW2 is pushed briefly.

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.....

(2)

(ii) Explain **one** reason for including SW3 in the circuit.

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.....

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(2)

(iii) Calculate the value of VR2 if the voltage on the gate of the thyristor (TH1) is 3V when SW2 is pushed.

Use the formula $VR2 = R1 \times \frac{V2}{V1}$

Show your working.

..... K

(2)

Leave blank

(iv) R3 is a protection resistor for LED1. The specification for LED1 is that it emits light at 1.5V with a current of 10mA.

Calculate the value of the resistor used to protect the LED.

Use the formula R = V/I

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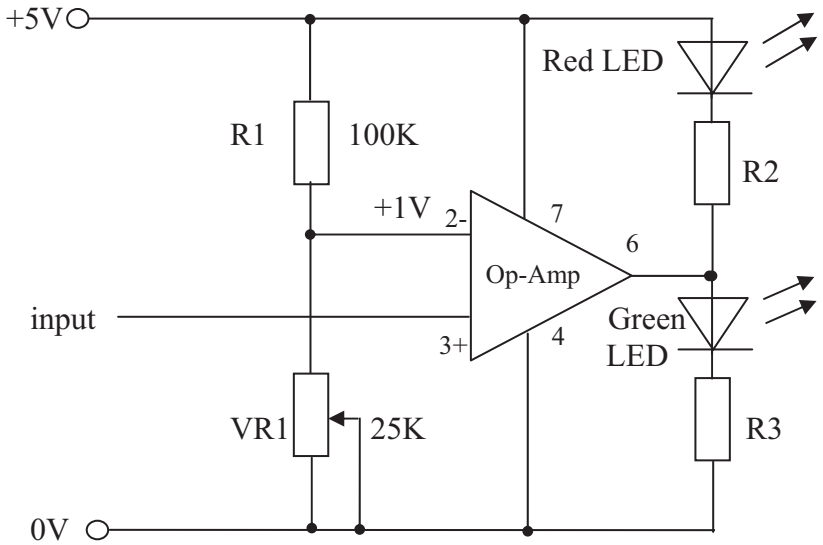
(2)

(b) A circuit diagram for an operational amplifier (Op-Amp) connected as a comparator is shown below.



(i) The output of the Op-Amp in the circuit above is ether at +5V or 0V.

From the list below, mark with a cross (☒) the LED or LEDs that will light when the output of the Op-Amp is 0V.

Red ☒ Green ☒ Both ☒ Neither ☒

(1)

(ii) Explain **one** action of the circuit when the input voltage is just greater than +1V.

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(2)

Leave blank

(c) Electronic products, such as mobile phones, can be manufactured using CAD/CAM.

Give **three** advantages to society of manufacturing mobile phones using CAD/CAM.

1 .....

2 .....

3 .....

(3)

(d) A manufacturer of mobile phones wants to make its production processes more environmentally friendly.

(i) Describe **one** way in which the environment will benefit from the manufacturer improving its waste management.

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.....

(2)

(ii) Describe **one** way in which the environment will benefit from the manufacturer using sustainable technology in its mobile phones.

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(2)

(e) Product reliability of mobile phones is important to consumers.

Explain **two** benefits to consumers of product reliability of mobile phones.

1 .....

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2 .....

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(4)

Q4

(Total 22 marks)

TOTAL FOR PAPER: 88 MARKS

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