

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

For Examiner's Use

General Certificate of Secondary Education
June 2008

**DESIGN AND TECHNOLOGY
(ELECTRONIC PRODUCTS) (SHORT COURSE)
Written Paper
Higher Tier**

3551/H

H



Monday 9 June 2008 1.30 pm to 3.00 pm

<p>For this paper you must have:</p> <ul style="list-style-type: none"> a pen, a pencil, a ruler, an eraser and a pencil sharpener. <p>You may use a calculator.</p>
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For Examiner's Use			
Question	Mark	Question	Mark
1		5	
2		6	
3			
4			
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show the working of your calculations.

Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- A list of formulae and other information, which you may wish to use in your answers, is provided on pages 2 and 3.
- You are reminded of the need for good English and clear presentation in your answers.

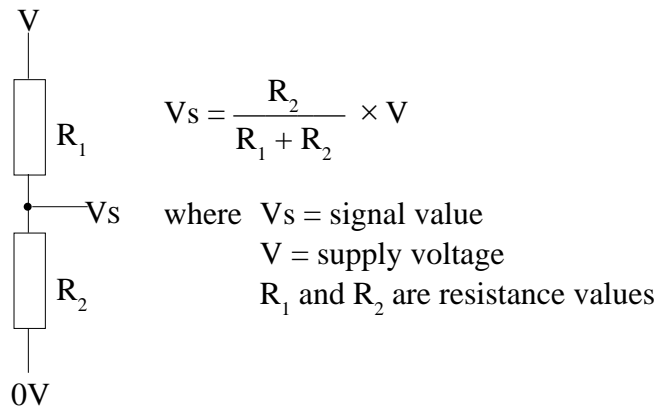
You may need to use one or more of the following formulae when answering questions which include calculations.

Potential Difference Potential Difference = Current \times Resistance ($V = I \times R$)

Series Resistors $R_{\text{total}} = R_1 + R_2 + R_3$ etc

Electrical Power Electrical Power = Current \times Potential Difference ($P = I \times V$)

Potential Divider



Time Constant Time Constant \approx Resistance \times Capacitance ($T \approx R \times C$)

Astable
Frequency for 555 $f = \frac{1.44}{(R_1 + 2R_2) \times C}$

Pulse duration $= \frac{1}{\text{frequency}}$

You may need to use the following information when answering some of the questions.

Capacitor series 10, 22, 47

Resistor Colour Code

Colour	Band 1	Band 2	Band 3 (No. of 0s)	Band 4 (Tolerance)
Black	0	0	None	
Brown	1	1	0	
Red	2	2	00	
Orange	3	3	000	
Yellow	4	4	0000	
Green	5	5	00000	
Blue	6	6	000000	
Violet	7	7	–	
Grey	8	8	–	
White	9	9	–	
				Gold = 5%
				Silver = 10%

Turn over for the first question

Turn over ►

Answer **all** questions in the spaces provided.

1 This question is about research and specification.



A student is designing a road safety product to be positioned on the ground behind a car to warn other motorists that a car has broken down. The product must be able to be seen in the dark by motorists to warn them to take extra care.

1 (a) Describe **two** different methods of finding out information about existing road safety products.

Method 1

.....

.....

.....

(2 marks)

Method 2.....

.....

.....

.....

(2 marks)

1 (b) Outline a method of evaluating the success of existing warning devices.

.....

.....

.....

.....

(2 marks)

1 (c) Write five specification statements relating to the road safety product which can be positioned behind a broken down car.

An example has been done for you.

e.g. LEDs are to be used to produce the light.

Specification 1
.....
(1 mark)

Specification 2
.....
(1 mark)

Specification 3
.....
(1 mark)

Specification 4
.....
(1 mark)

Specification 5
.....
(1 mark)

Turn over for the next question

11

Turn over ►

2 This question is about designing the case of the product.

2 (a) In the box below sketch a design idea for the road safety product to be positioned on the ground behind a car.


This should show the following aspects:

- the specific materials which would be used.
- how it is made stable whilst standing on the ground.
- how it is suitable for storing in the car.

(6 marks)

2 (b) Using notes and sketches, develop your design for the case of the road safety product, to contain a circuit with six LEDs and an LDR, to detect the light level. Your design must include the following aspects:

- the position of the six LEDs.
- how the LEDs are held securely in place.
- the position of an off/on switch.
- the position of the LDR and how it is fitted in the case.
- access to the inside of the case.



(13 marks)

Quality of communication (3 marks)

22

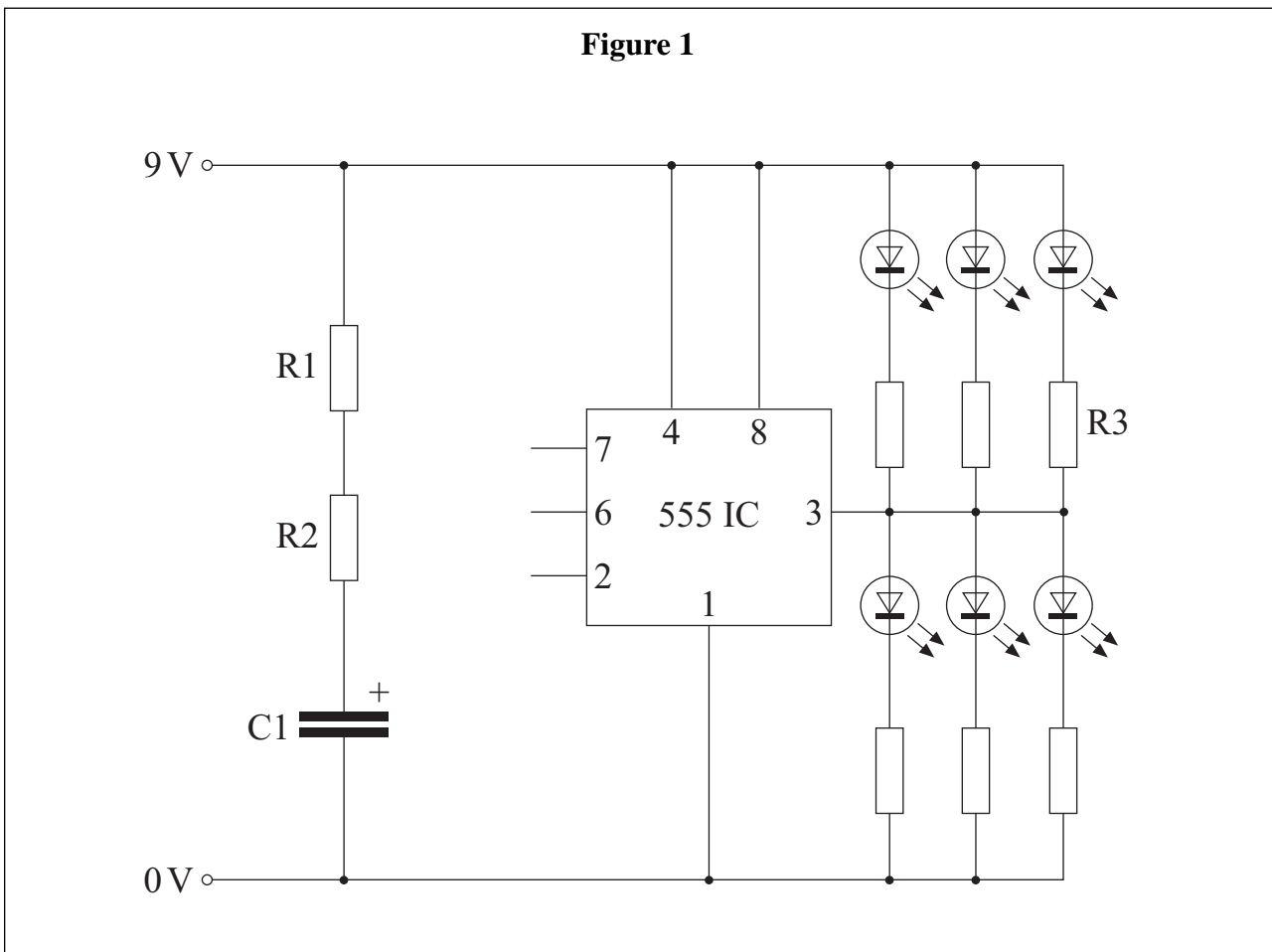
Turn over ►

3 This question is about an astable.

During their research a student finds a 555 IC astable and decides to connect six LEDs to the output:

- three are sinking (on when the astable output is low).
- three are sourcing (on when the astable output is high).

An incomplete circuit diagram is shown in **Figure 1**.



3 (a) Complete the circuit diagram in **Figure 1** by drawing the connections to make it work as an astable.

(3 marks)

3 (b) Circle the alternative name for the astable which also describes what it does.

Switch De-bouncer

Pulse Generator

Time Delay

(1 mark)

3 (c) Each LED has a current limiting resistor connected in series.

Calculate the value of the resistor R3 in **Figure 1** if the LED requires 2V and 20mA to be at full brightness.

Formula:

Working:

Answer (with units):
(5 marks)

3 (d) When the circuit in **Figure 1** was tested the LEDs in the top half were brighter than the LEDs in the bottom half.

Explain why this has happened and suggest a suitable modification to the circuit.

Explanation
.....
.....
.....
(2 marks)

Modification
.....
.....
.....
(2 marks)

Turn over for the next question

4 This question is about Industrial Processes.

4 (a) CAD software is often used to design the circuit board layout.

Identify **three** advantages this has for the designer.

Advantage 1.....
.....
(1 mark)

Advantage 2.....
.....
(1 mark)

Advantage 3.....
.....
(1 mark)

4 (b) State and explain **two** different health and safety considerations when producing a circuit board by photo-etching.

Consideration 1.....
.....
.....
.....
.....
.....
(3 marks)

Consideration 2.....
.....
.....
.....
.....
.....
(3 marks)

- 4 (c) In the box below draw a flow diagram to show the main stages in producing a circuit board by the process of photo-etching.

Circuit layout complete using CAD software

Circuit board complete ready for drilling and placing components

(11 marks)

20

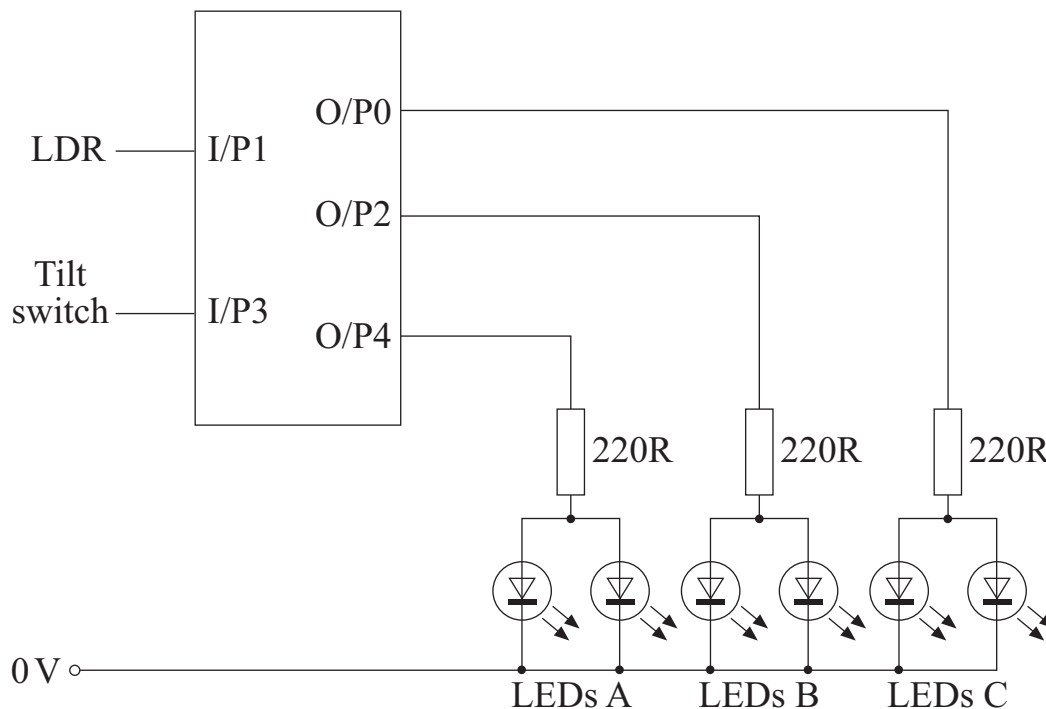
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5 This question is about a Programmable Integrated Circuit (PIC).

Figure 2 shows a circuit using an 8 pin PIC to control the LEDs for the road safety device.

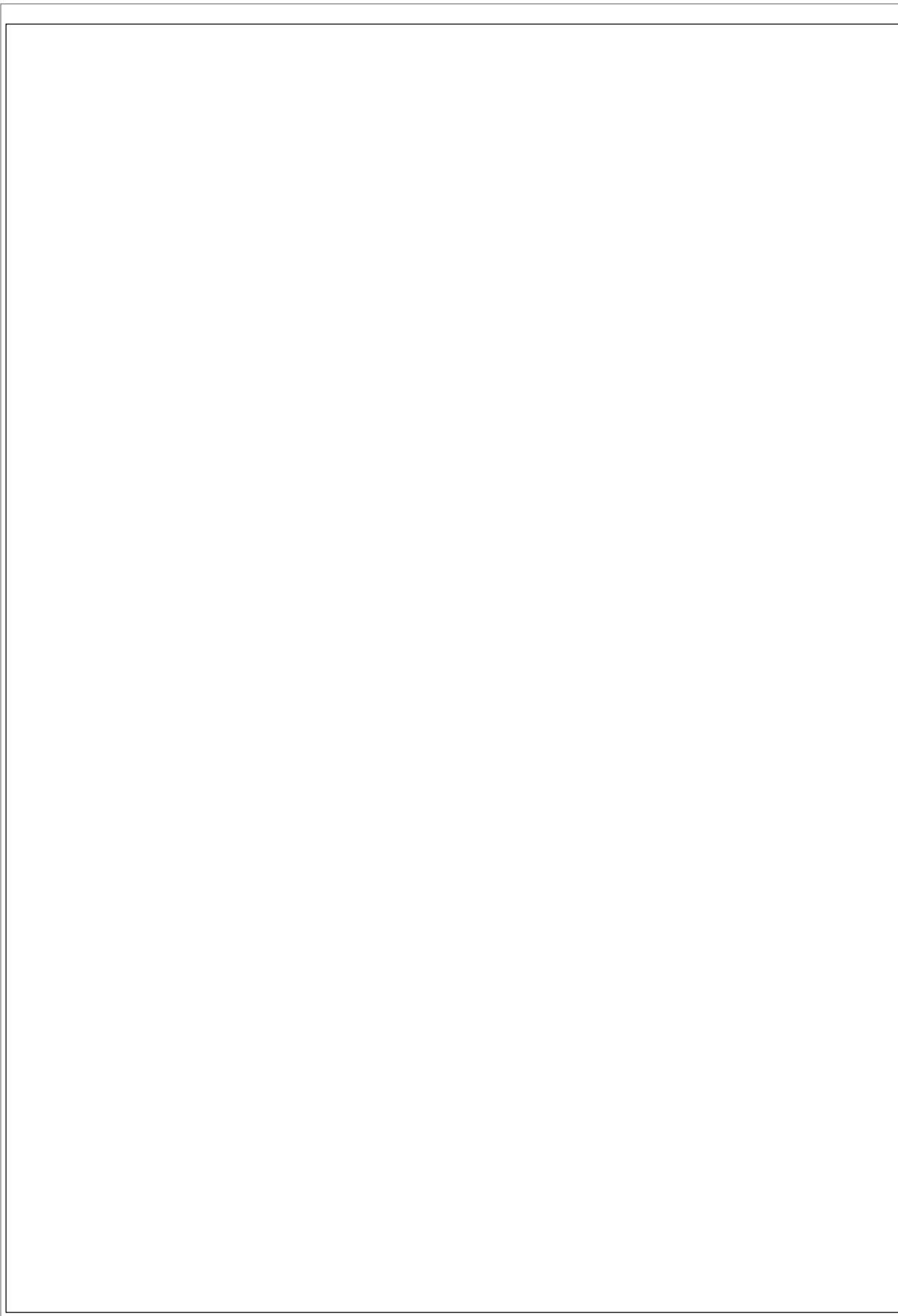
A tilt switch has been added to activate the PIC when the product is positioned on the ground behind the car.

Figure 2



When nearly dark the LDR has an analogue value of 75 and as it gets darker its value falls. Using a programming system you are familiar with write a programme on page 13 opposite to control the PIC so that it behaves as outlined below:

- 5 (a) The circuit activates when the tilt switch is on and the light level around the LDR is 75 or less. (5 marks)
- 5 (b) When activated the LEDs flash in sequence A, B, C and B (only one pair of LEDs are on at a time). Each LED is to be on for 0.25s. This repeats 10 times. (10 marks)
- 5 (c) All the LEDs then come on together for 0.5s and go off for 0.5s. This sequence is repeated 5 times. (5 marks)
- 5 (d) The programme repeats until deactivated. (2 marks)



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Turn over ►

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**