

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

For Examiner's Use

General Certificate of Secondary Education
June 2006

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

**3551/H
H**



Wednesday 14 June 2006 1.30 pm to 3.00 pm

For this paper you must have:

- a pen, pencil, ruler, eraser, pencil sharpener and coloured pencils

You may use a calculator.

For Examiner's Use			
Question	Mark	Question	Mark
1		4	
2		5	
3		6	
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen. Use pencil and coloured pencils only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- 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.

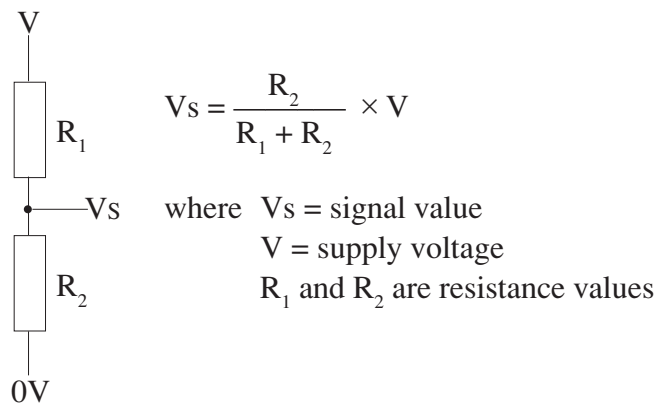
You may need to use one or more of the following formulae when answering questions which include calculations.

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 designing a circuit.

An advertising company has asked you to design a small electronic torch as a promotional gift.

(a) List **three** things which you need to consider before you begin to design the product. Give an explanation or reason for each. An example has been given to help you.

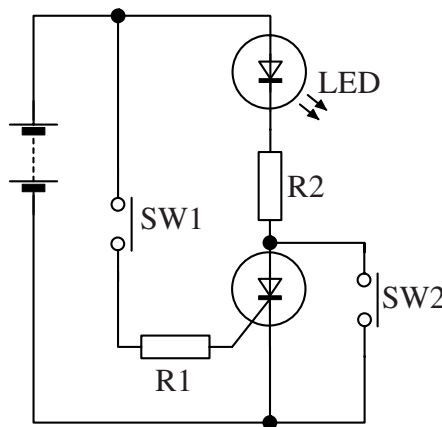
For example: The price must not exceed £2 otherwise it will be too expensive.

- 1
-
- 2
-
- 3
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(6 marks)

(b) A circuit for the torch using a Thyristor and an LED is shown in **Figure 1**.

Figure 1



Explain what happens when the following actions are carried out in the order shown.

(i) SW1 is pressed and released.

-
-
-
-

(2 marks)

(ii) SW2 is pressed and released.

.....

.....

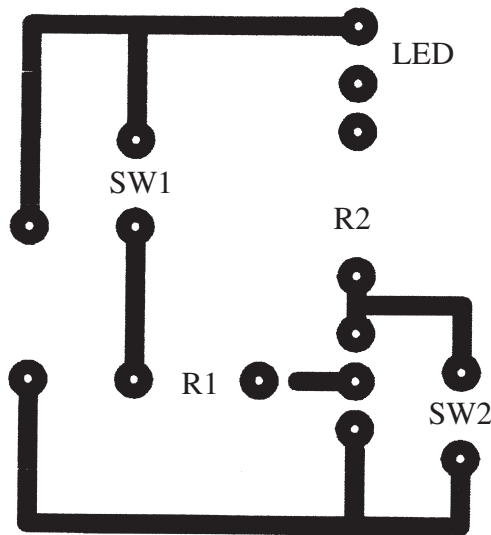
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(2 marks)

(c) The PCB layout of the circuit in **Figure 1** is shown in **Figure 2**.

Figure 2



When the circuit was built, it did not work.

On **Figure 2**, identify **two** mistakes which could be the cause of the problem by drawing a circle round each mistake.

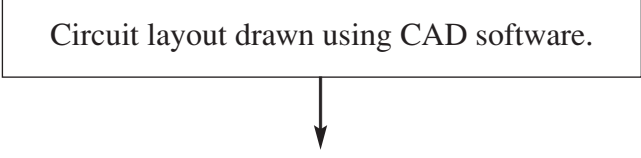
(2 marks)

2 This question is about producing a circuit on PCB.

- (a) Using a production method you are familiar with, set out the stages needed when making a circuit board, prior to drilling and adding the components.

Start:

Circuit layout drawn using CAD software.



Finish:

Circuit board made.



(10 marks)

- (b) Health and Safety is important when making the PCB, drilling the holes and soldering the components in place.

Identify **two** different hazards and the precautions which need to be taken to prevent a problem occurring.

(i) Hazard 1:

Precaution:

.....
(2 marks)

(ii) Hazard 2:

Precaution:

.....
(2 marks)

- (c) Identify **two** Quality Control checks you could make to the finished circuit after the components are soldered in place.

1

.....

2

.....
(2 marks)

Turn over for the next question

Turn over ►

3 This question is about designing the case for a product.



A student is designing a rear warning light for a bicycle.
The case for the light is to be made by vacuum forming.

(a) (i) Name a suitable material that could be used to make the case.

.....
(2 marks)

(ii) Explain, using notes and sketches, the stages in the vacuum forming process when making the case.

(5 marks)

(b) The warning light is battery powered, has an On/Off switch and four LEDs. Using notes and sketches, develop a design for the case which shows the following features:

- the position of the four LEDs;
- a way of holding the LEDs in the case;
- the position of the On/Off switch;
- how the battery can be easily changed.

Quality of communication (8 marks)
(2 marks)

(c) Use notes and sketches to show a method of attaching the case to the bicycle.

Quality of communication (6 marks)
(2 marks)

Turn over ►

4 This question is about PIC microcontrollers.

The student developing the warning light from **Question 3** wants the LEDs to flash on and off and is considering using a PIC.

(a) Compare the use of a PIC with a 555 Timer IC to control the LEDs.

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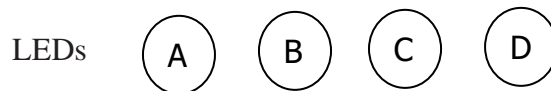
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(4 marks)

(b) Using a programming system you are familiar with, produce a sequence of commands which would make a set of 4 LEDs, shown in **Figure 3**, switch on as shown below. Next to each of the commands, explain its purpose.

Figure 3



- All four LEDs go high for 1 second.
- A, B, C and D go high in sequence, each for 0.25 seconds.
- All four LEDs go high for 1 second.
- D, C, B and A go high in sequence, each for 0.25 seconds.
- This repeats continuously.
- **Between each statement, all LEDs go low for 0.25 seconds.**

Produce your programme on page 11.

5 This question is about a monostable circuit.

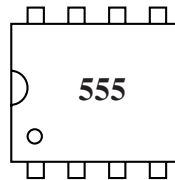
A student is designing a small light for emergencies and has decided to include a feature which would automatically switch off the light after an amount of time.

A 555 IC, operating as a monostable, can provide the time delay.

(a) The 555 IC is in an 8 pin DIL arrangement.
On the plan view in **Figure 4**:

- clearly label Pin 2 with a 2
- clearly label Pin 7 with a 7

Figure 4



(2 marks)

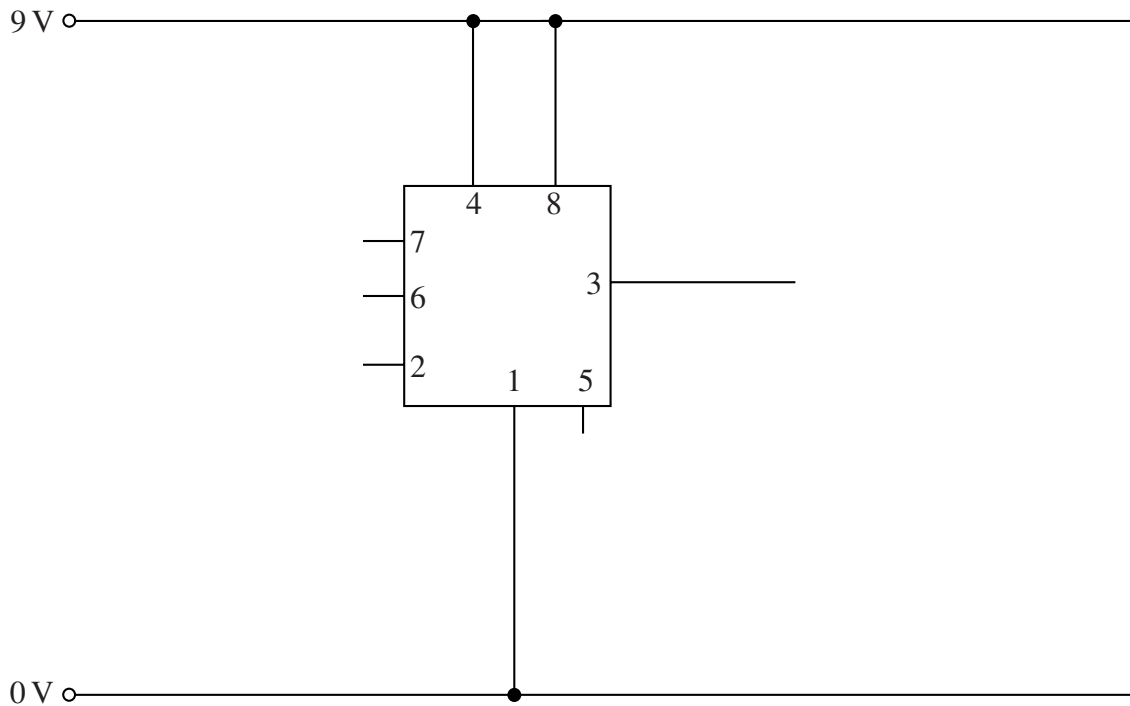
(b) **Figure 5** (on page 13) shows an incomplete circuit diagram for the monostable circuit.

Complete **Figure 5** by adding the following components:

- (i) a fixed resistor and polarised capacitor to Pins 6 and 7 to create a timing potential divider; (3 marks)
- (ii) a 10K fixed resistor between Pin 2 and 9V; (2 marks)
- (iii) a push to make switch between Pin 2 and 0V; (2 marks)
- (iv) a fixed resistor, a suitable transducer driver and lamp to the output, Pin 3, so that it will light when Pin 3 goes high. (3 marks)

Quality of drawing (2 marks)

Figure 5



(c) Explain why the lamp should **not** be connected directly to the output of the 555 IC.

.....

.....

.....

(2 marks)

(d) Calculate the time constant for the monostable if the resistor is 470 K and the capacitor is 100 μ F.

Formula:

Working:

Answer with units:

(4 marks)

6 This question is about social and environmental issues.

The development of electronic products is having a major impact on society.

(a) Explain how electronic communication has affected people’s working lives.

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.....
.....

(3 marks)

(b) Explain how electronic communication has affected the consumer.

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(3 marks)

(c) Describe the consequences for the environment of the development of electronic products.

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(3 marks)

END OF QUESTIONS

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