

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Secondary Education
June 2005

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

3551/H

H



Thursday 16 June 2005 1.30 pm to 3.00 pm

In addition to this paper you will require:
blue or black pen, pencil, coloured pencils and ruler.
You may use a calculator.

For Examiner's Use	
Number	Mark
1	
2	
3	
4	
5	
6	
TOTAL	
Examiner's initials	

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 100.
- Mark allocations are shown in brackets.
- A list of formulae and other information is given on pages 2 and 3 which you may need to use when answering certain questions.
- Wherever calculations are needed you should show your working.
- You are reminded of the need for good English and clear presentation.

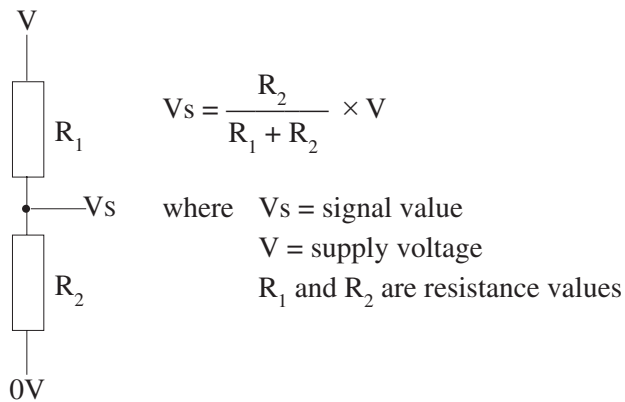
You may need to use one or more of the following formulae when answering questions which include calculations.

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 **Figure 1** shows a block diagram of a fire alarm.

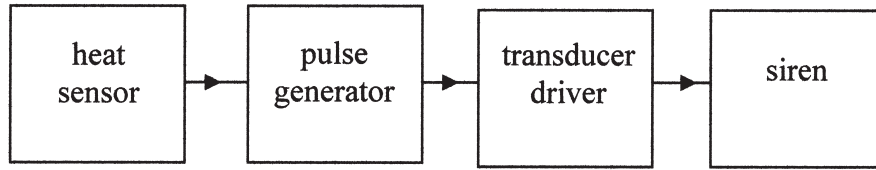


Figure 1

(a) **Figure 2** shows a circuit used as part of the system.

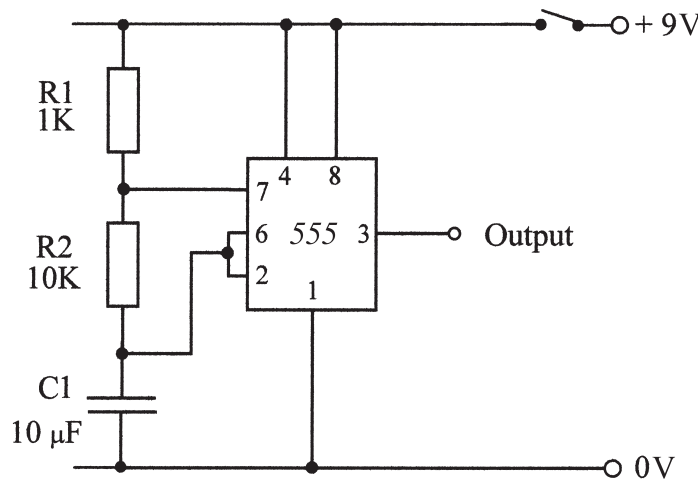


Figure 2

(i) Give the name that best describes this circuit.

.....
(1 mark)

(ii) State which block in **Figure 1** is represented by the circuit in **Figure 2**.

.....
(1 mark)

(b) Calculate the frequency of the circuit.

Formula

Working

Answer with units
(6 marks)

(c) State what happens to the output when the potential difference across **C1** reaches 6 V.

.....
(1 mark)

(d) **Figure 3** shows a method of modelling the circuit.

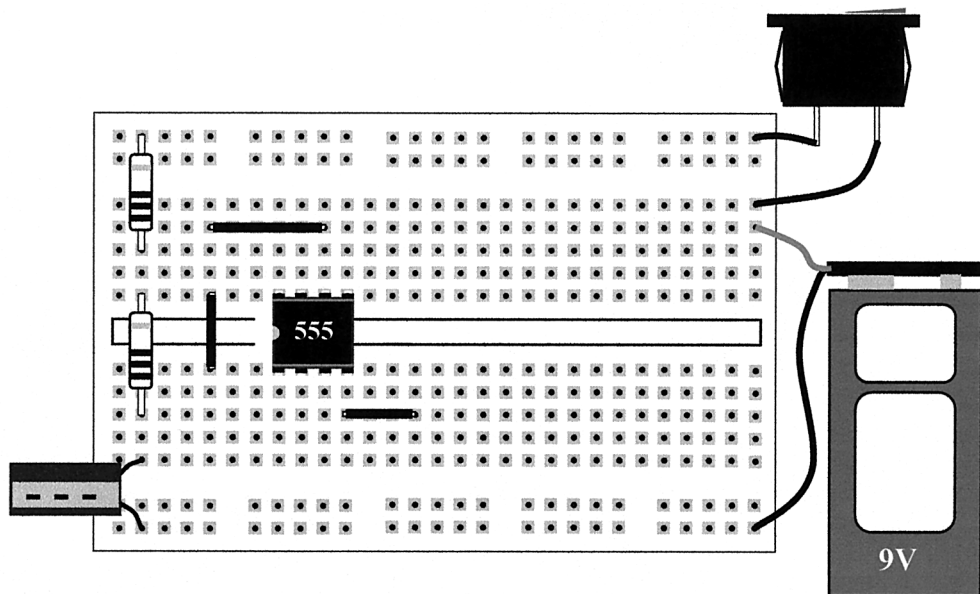


Figure 3

(i) Name the method of modelling used in **Figure 3**.

.....
(1 mark)

(ii) Explain **one** advantage of using this method when modelling circuits as opposed to using computer simulation software.

Advantage

.....
(2 marks)

(iii) Complete **Figure 3** by adding **six** wire connections to make the circuit work as intended.

(6 marks)
Quality of drawing (1 mark)

2 It is decided that the fire alarm in **Question 1** would benefit from adding a timed testing block.

(a) Complete **Figure 4** to show where in the system the monostable test would be connected.

(1 mark)

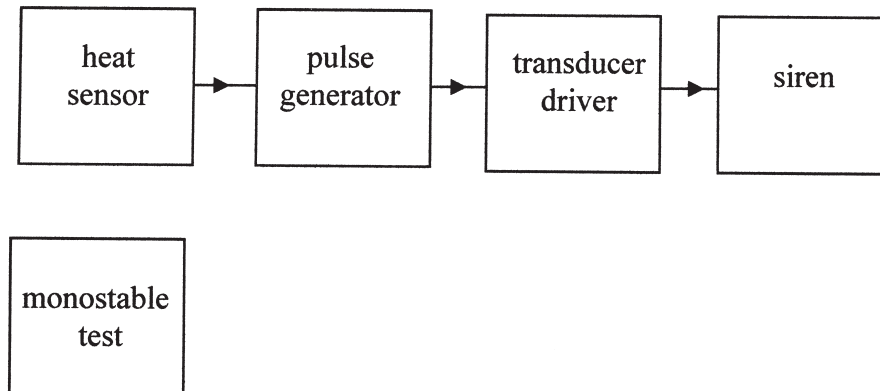


Figure 4

(b) **Figure 5** shows an incomplete circuit used as the monostable test part of the system.

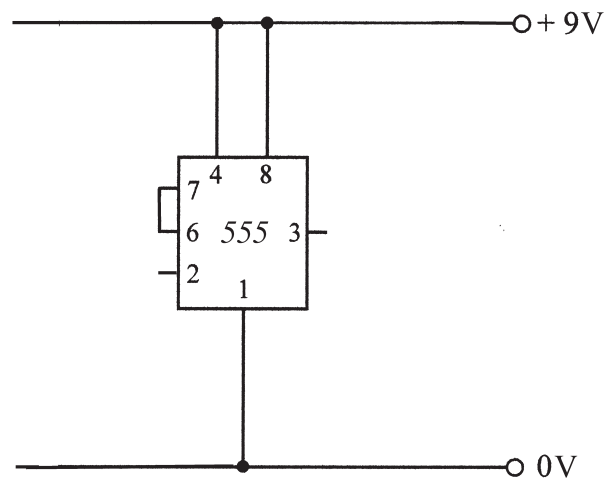


Figure 5

(i) Complete **Figure 5** by adding:

- a 100K resistor and a 470 μF capacitor that will control the time delay;
- a pull up resistor and a push to make switch to trigger the time period.

(6 marks)

Quality of drawing (1 mark)

(ii) Calculate the time delay of the circuit in **Figure 5**.

Formula

Working

Answer with units

(4 marks)

12

TURN OVER FOR THE NEXT QUESTION

Turn over ►

3 You have been asked to design an electronic dice to be used by children when playing games.

Analysis

- (a) List **two** things that you should think about when designing the electronic dice. An example has been given.

The likely cost of the whole project including both components and materials.

1

2

(4 marks)

Research

The layout of a research plan for the electronic dice is shown in **Figure 6**.

- (b) Complete **Figure 6** by adding suitable research sources and stating the information that you would hope to find. (7 marks)

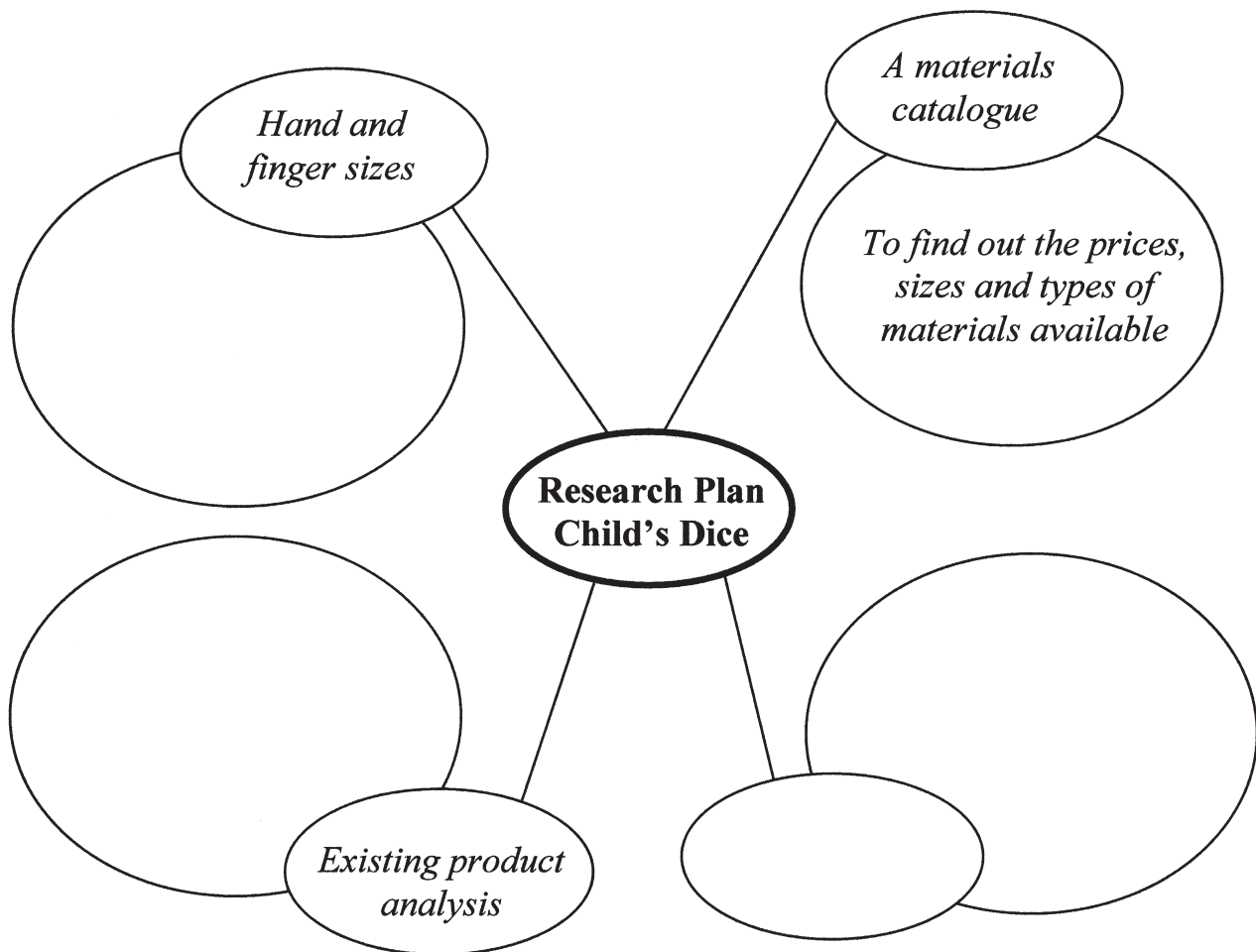


Figure 6

(c) Describe how the information from the analysis and research may affect the final design.

.....
.....
.....

(2 marks)

(d) Give **four** specification points for the electronic dice. **Two** of the points should be about the casing and **two** about the electronics. Examples have been given.

(i) Casing specifications

Not too heavy – so that it can be used by young children.

1

2

(4 marks)

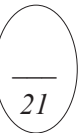
(ii) Electronic specifications

The numbers will be made up from arrangements of 5 mm LEDs.

1

2

(4 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

4 This question is about designing, making and evaluating the electronic dice.

(a) (i) Use notes and sketches to show:

- a design for the casing of the dice; *(4 marks)*
- how the dice is switched on and activated. *(2 marks)*

Quality of communication *(2 marks)*

(ii) Give the name of a suitable material from which the casing could be made.

Material

(1 mark)

(iii) Use notes and sketches to show:

- a suitable method of fitting an LED into the case; *(2 marks)*
- how the circuit is securely held in place in the casing. *(3 marks)*

- (b) List **two** situations where health and safety hazards might be an issue whilst making the casing and give the precaution that you would need to take.

Situation 1

Precaution

.....

Situation 2

Precaution

.....

(4 marks)

- (c) Explain **two** methods of evaluating the finished dice.

1

.....

2

.....

(4 marks)

- (d) Give **two** reasons why quality checks need to be made during the making of electronic products.

1

.....

2

.....

(4 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 5 A company who manufactures lifts for hotels, hospitals and office buildings is presently using an operating system made from discrete electronic components to control the lifts.

The owner of the company is considering replacing the present system of lift control with a PIC microprocessor control system.

- (a) Explain **one** advantage and **one** disadvantage of installing a PIC microprocessor control system compared to using the present system.

Advantage

.....
(2 marks)

Disadvantage

.....
(2 marks)

Figure 7 shows a drawing of a lift with its doors open at the ground floor.

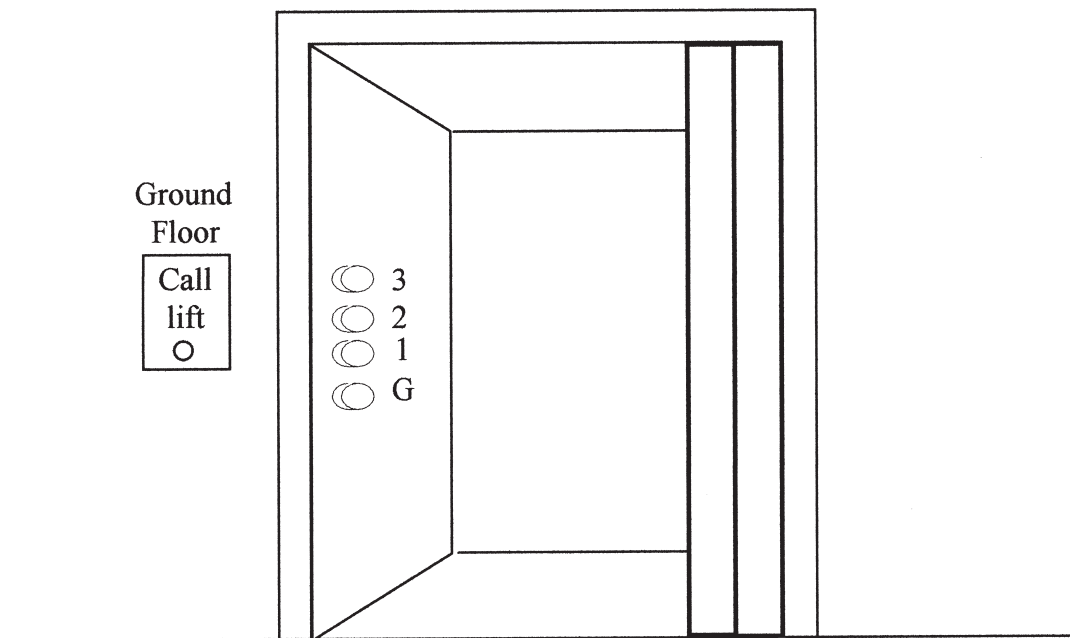


Figure 7

The lift will only work when a person has requested the lift from another floor **or** a floor has been chosen by a person in the lift **and** the doorway is not obstructed.

- (b) Complete **Figure 8** by designing a flow chart to illustrate the lift operating sequence from when the lift starts at the ground floor with its doors open and is called to the first floor where its doors open.

(10 marks)

Quality of drawing (2 marks)

Lift called from
first floor



Doors open at first floor

Figure 8

6 During the past twenty years the use of ICT and electronic control systems have revolutionised manufacturing.

Explain **one** advantage and **one** disadvantage that these developments have had for the environment.

Advantage

.....

.....

(3 marks)

Disadvantage

.....

.....

(3 marks)

END OF QUESTIONS

6

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