

Surname						Other Names					
Centre Number						Candidate Number					
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For Examiner's Use

General Certificate of Secondary Education
June 2007

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

3551/H

H



Wednesday 13 June 2007 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 blue or black ink or ball-point pen. Use pencil 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.



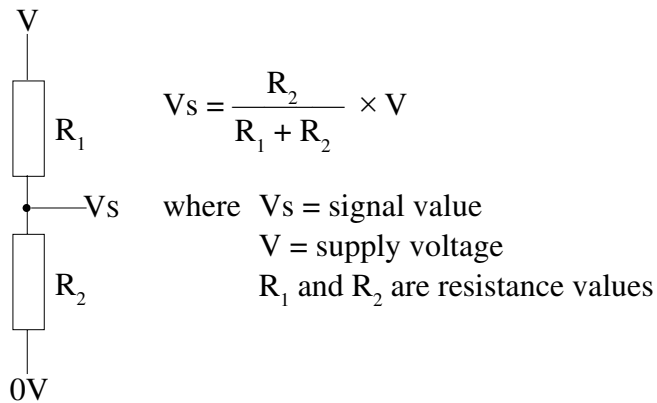
You may need to use one or more of the following formulae when answering questions which include calculations.

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.

This question is about research and analysis.

You are advised to spend about 20 minutes on this question.

- 1 (a) A student is starting to design a project based on a steady hand game.

Describe **two** methods a student could use to find information about existing electronic games.

Method 1

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Method 2.....

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(4 marks)

- (b) In order to find out the features which might be wanted by people who play electronic games, a survey could be conducted.

Write **three** different questions a student could ask and give a reason for **each** to show how this will help with the design of the product.

An example is given.

Example:

Question – Should the game be portable?

Reason – This will affect the size, weight and possible power source.

Question 1.....

Reason

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Question 2.....

Reason

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Question 3.....

Reason

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(6 marks)



- (c) From the survey it appears that most people would prefer to use a battery-powered game. Give **two** reasons why.

Reason 1

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Reason 2

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(4 marks)

- (d) Why do some people prefer to use re-chargeable batteries?

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(2 marks)

- (e) When batteries come to the end of their useful life they need to be disposed of.

- (i) How can this be achieved safely?

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(1 mark)

- (ii) Give **two** reasons why batteries should be disposed of carefully.

Reason 1

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Reason 2

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(4 marks)

Turn over for the next question

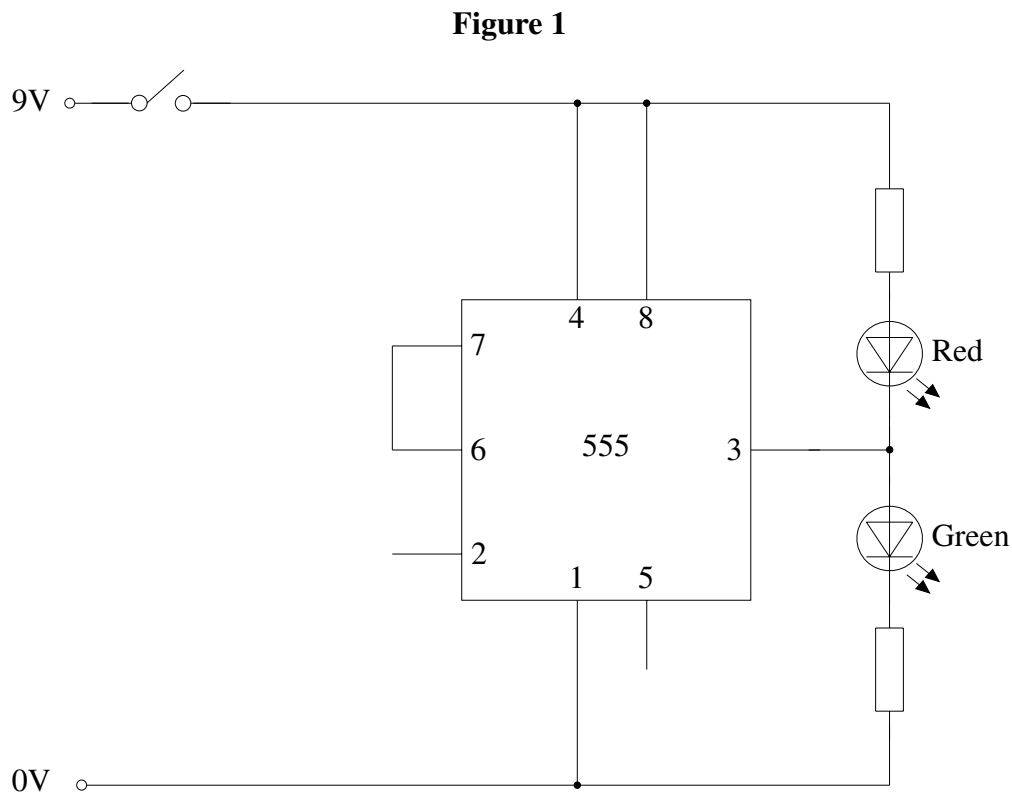
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This question is about monostable circuits.

You are advised to spend about 15 minutes on this question.

2 **Figure 1** shows an incomplete circuit diagram for a monostable using a 555 Timer I C.



(a) Complete the circuit diagram for a monostable in **Figure 1** by

- (i) adding a 100 K fixed resistor and a 22 μF capacitor to Pins 6 and 7 to give a time constant of approximately 2 seconds, (3 marks)
- (ii) adding a fixed resistor and a suitable switch to Pin 2 so as to trigger the 555 Timer I C when the switch is pressed. Clearly label the resistor to show its value. (4 marks)

Quality of drawing (2 marks)



(b) Describe what happens to the LEDs when the circuit is switched on and then triggered.

(i) circuit switched on

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(2 marks)

(ii) circuit triggered

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(2 marks)

(c) A circuit can be modelled using either Computer Aided Design or a breadboard. Compare the two methods.

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(5 marks)

Turn over for the next question

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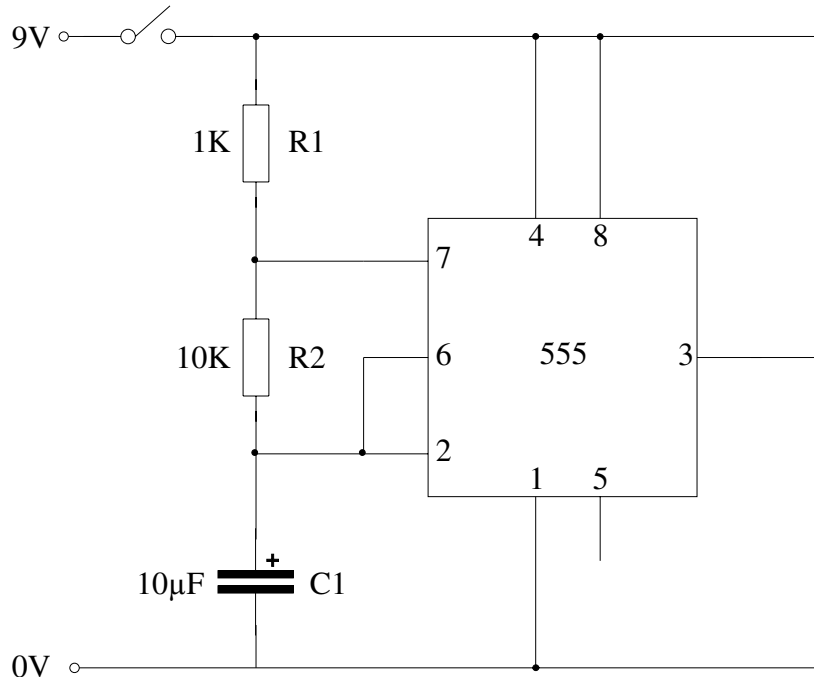


This question is about astable circuits.

You are advised to spend about 5 minutes on this question.

- 3 A student wants a sound to pulse as part of the output for the game. **Figure 2** shows an astable circuit that could produce such an output.

Figure 2



- (a) Calculate the frequency of the output from Pin 3.

Formula

Working

Answer with units.....
(5 marks)

- (b) Add a buzzer to the output, Pin 3, of the 555 Timer I C in **Figure 2**, so that it will sound when the output goes high. (2 marks)

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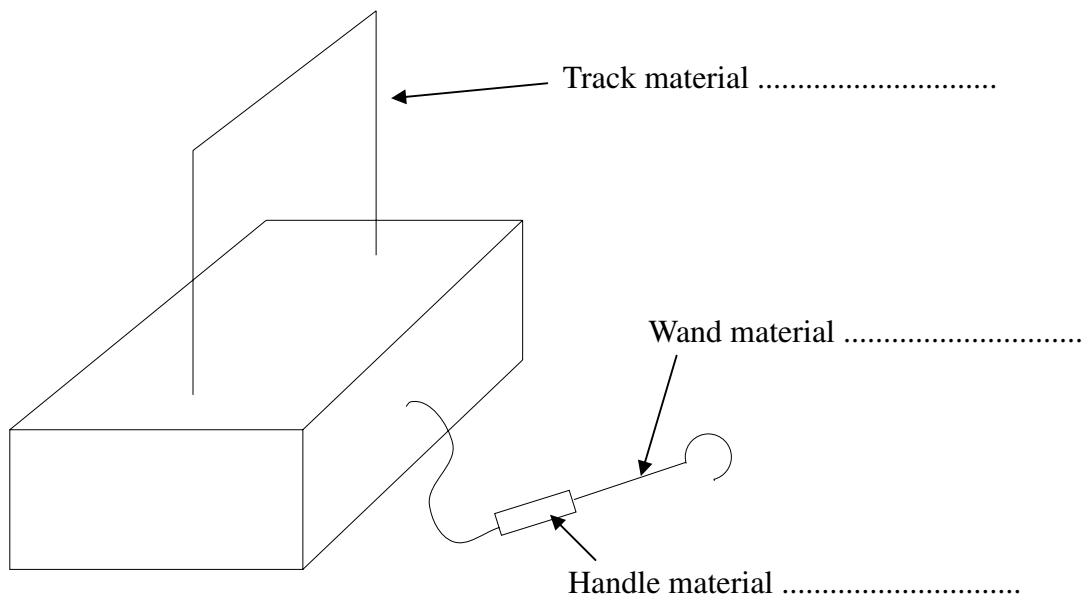
This question is about designing the case for a product.

You are advised to spend about 30 minutes on this question.

4 A simple design for a steady hand game is shown in **Figure 3** which could house a similar circuit to the one developed in **Question 2**.

(a) On **Figure 3** label suitable materials for the track, wand and handle.

Figure 3



(3 marks)

(b) Suggest **three** improvements to the design in **Figure 3** above.

1

2

3

(3 marks)

This question continues over the page

Turn over ►



(c) Using sketches and notes, show how you would improve the design of the steady hand game using the following specification points.

(i) a suitable specific material for the case (2 marks)

(ii) your suggested improvements from part (b) (6 marks)

(iii) the position of the **two** LEDs (1 mark)

(iv) sound holes for a buzzer (1 mark)

(v) a suitable on/off switch (2 marks)

Quality of communication (3 marks)

Chosen specific material

Use the space below to complete your answer.



- (d) Evaluate your case design for its suitability for commercial production in batches of 100. Give reasons for any changes you suggest.

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(6 marks)

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Turn over for the next question

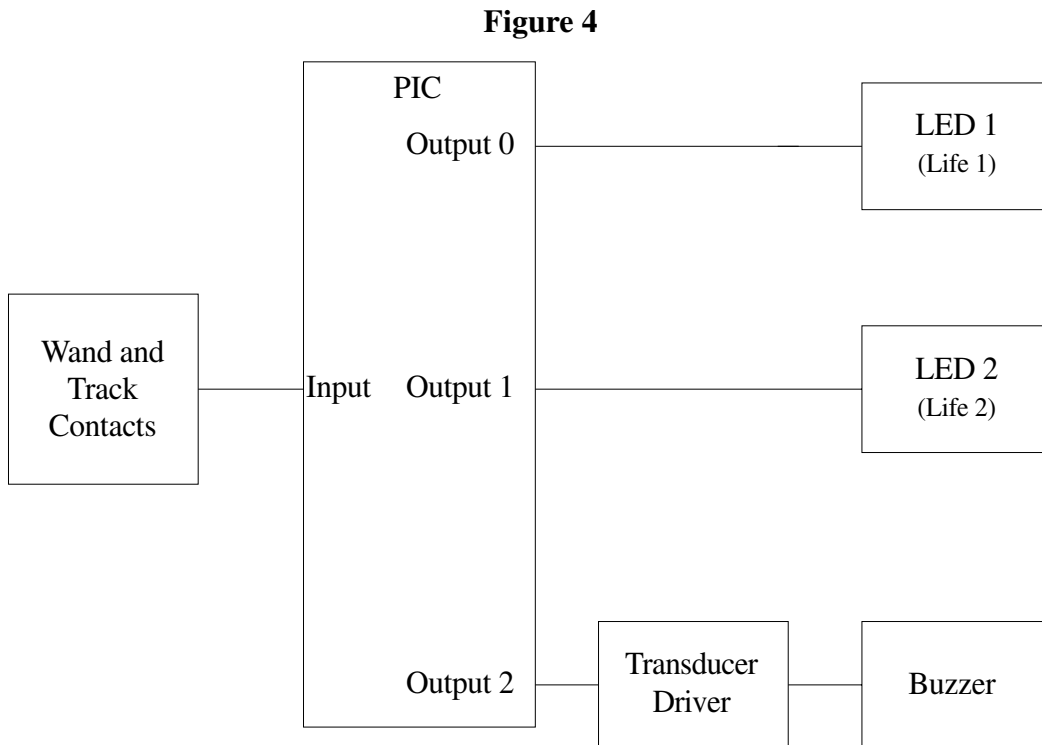
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This question is about Peripheral Interface Controllers (PICs).

You are advised to spend about 10 minutes on this question.

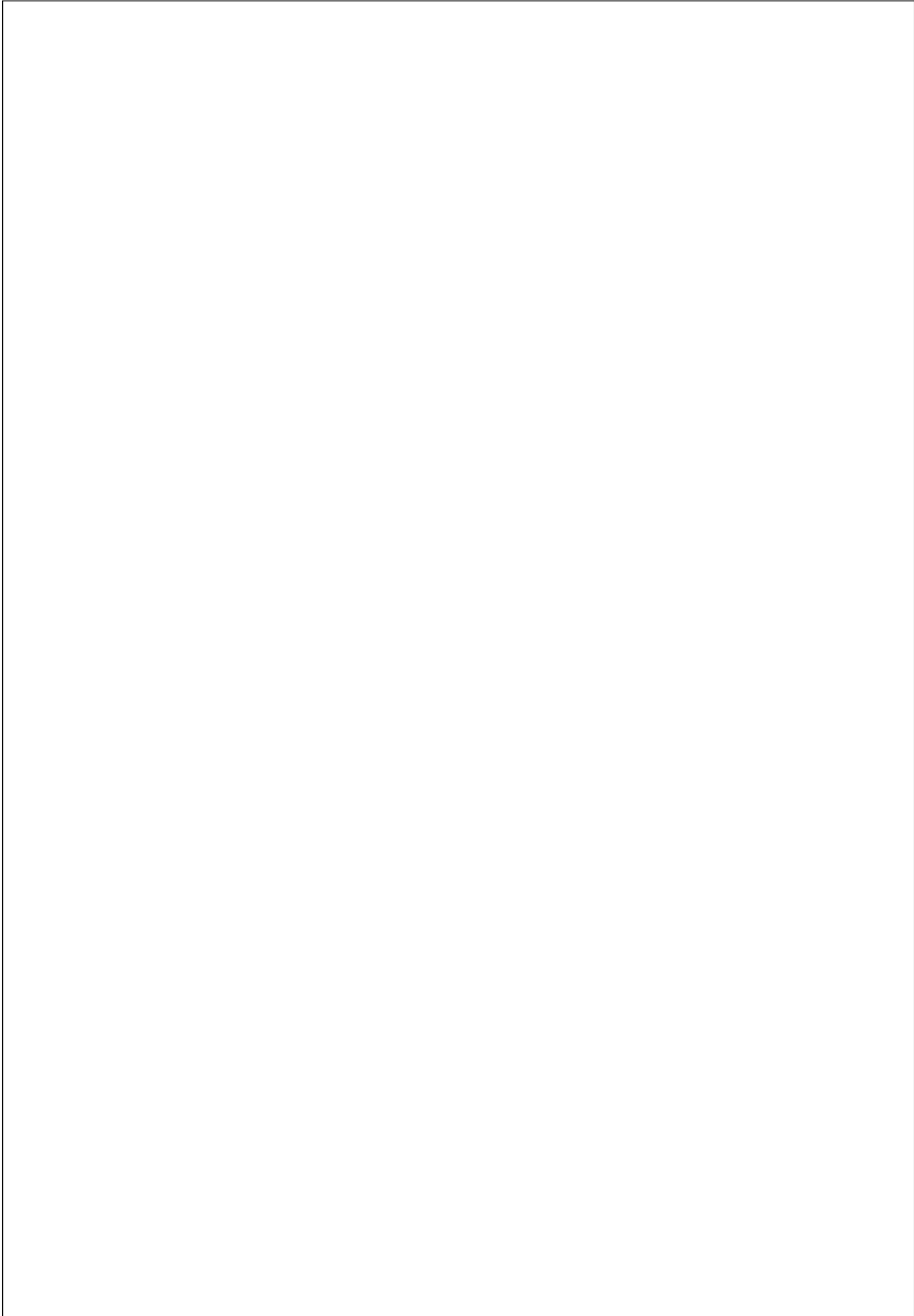
- 5 The student has decided to use a PIC to simplify the electronic circuit for the steady hand game and has drawn a PIC system diagram as shown in **Figure 4**.



On page 13 in the space provided, using a programming method you are familiar with, design a PIC programme to satisfy the following conditions.

- (a) Each time the wand and track touch, the PIC switches on an LED in the sequence 1 then 2. Once an LED is lit it will stay on until reset. *(7 marks)*
- (b) Once the wand and track touch, the PIC will ignore any further contact between the wand and track for 2 seconds. *(4 marks)*
- (c) The buzzer sounds for 10 seconds when the second life is lost. *(3 marks)*
- (d) The PIC programme will re-set back to 'no lives lost'. *(3 marks)*





17

Turn over ►



1 3

This question is about the social, moral and environmental aspects of mobile telephones.

You are advised to spend about 10 minutes on this question.

- 6 (a) Mobile telephones have changed the way we communicate at work and during our leisure time.

Compare the advantages **and** disadvantages of the increased use of this type of technology.

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(6 marks)



(b) When new, mobile telephones are usually packaged in boxes.

(i) Explain why they are packaged in this way.

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(2 marks)

(ii) Explain how this packaging can be a problem for the environment.

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(2 marks)

END OF QUESTIONS

10



There are no questions printed on this page

