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| Surname | | Other Names | |
| Centre Number | | Candidate Number | |
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General Certificate of Secondary Education
June 2004

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

**3551/H
H**



Friday 28 May 2004 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 | |
| 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.

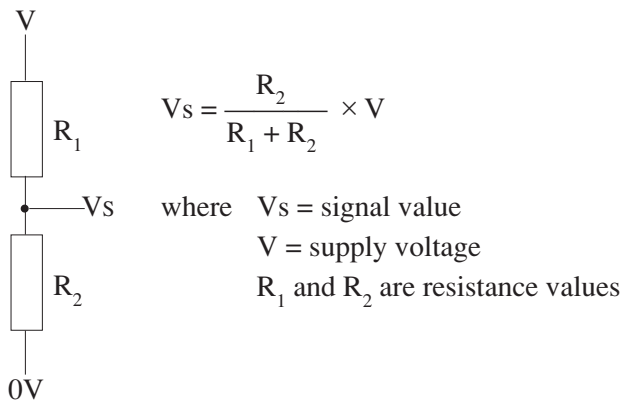
You may need to use one or more of the following formulae when answering questions which include calculations.

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 ►

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

1 **Figure 1** shows a circuit to be used as a timer.

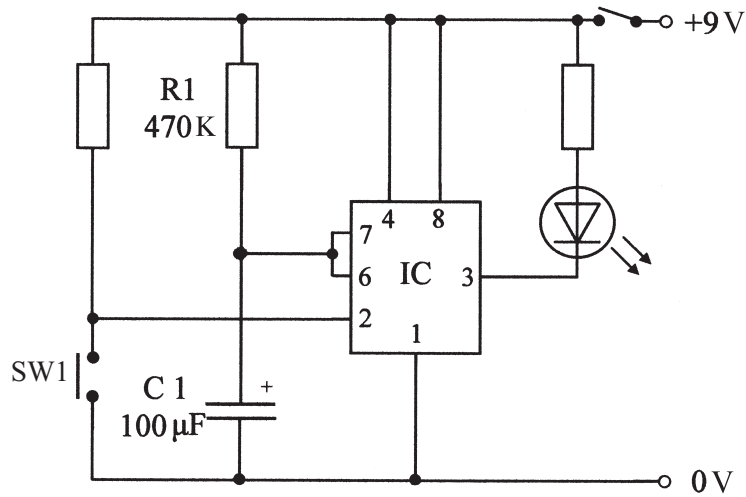


Figure 1

(a) Name the type of circuit shown in **Figure 1**.

.....
(1 mark)

(b) Complete **Figure 2** by:

(i) identifying **three** components from the circuit in **Figure 1** that need to be connected the right way round;

(3 marks)

(ii) explaining what features of each component help to make sure that it is connected into the circuit the right way round.

(6 marks)

| Component | Explanation |
|-----------|-------------|
| | |
| | |
| | |

Figure 2

(c) Name the **two** components that control the length of the time delay.

.....
(2 marks)

(d) Explain the function of **SW1**.

.....
(1 mark)

(e) Calculate the time delay of the circuit shown in **Figure 1**.

Formula

Working

Answer and Units
(3 marks)

(f) The time delay, when tested, did not match what was expected.

Explain why the tolerance of the capacitor was a likely cause.

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

(g) State the readings and units that you would expect to find at the following places on the circuit when it is working.

(i) The voltage at Pin 3 when SW1 is pressed.

.....
(1 mark)

(ii) The voltage at Pin 3 when the voltage at Pins 7 and 6 reaches 6 V.

.....
(1 mark)

2 This question is about designing a case for a timer circuit.

Figure 3 shows a *full size* drawing of the PCB and the components of the circuit.

(a) Sketch **two** different ideas for the casing of the timer.

Your ideas should show well drawn and labelled sketches that include suggestions of both the different materials and suitable construction methods that could be used.

(9 marks)

Quality of drawing (3 marks)

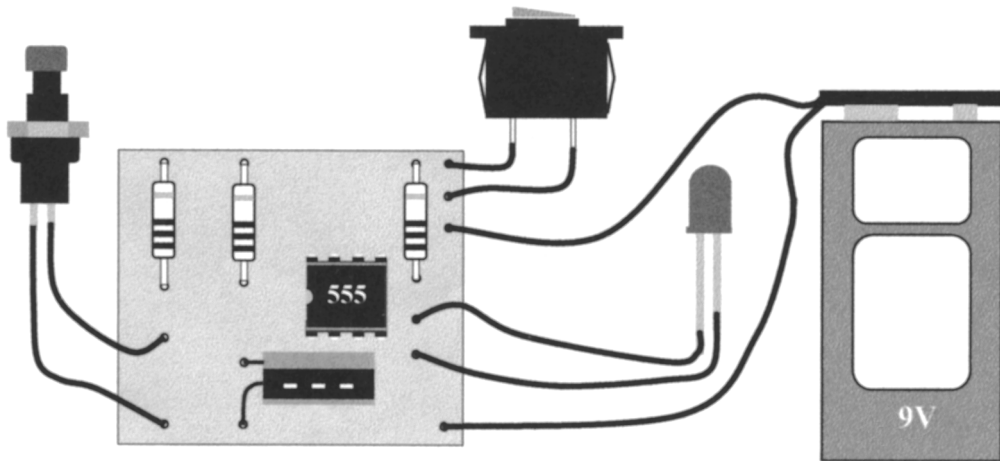


Figure 3

(b) Choose **one** of your ideas and show using notes and quality sketches the details of:

- the specific material used for the case; *(1 mark)*
- the method of construction for the material chosen; *(2 marks)*
- the sizes/dimensions of the case; *(2 marks)*
- how the circuit and battery are made accessible; *(3 marks)*
- the positions of the two switches and the LED. *(3 marks)*

Quality of drawing *(3 marks)*

3 **Figure 4** shows the outline of a disco light box controlled by a PIC and the layout of the lamps.

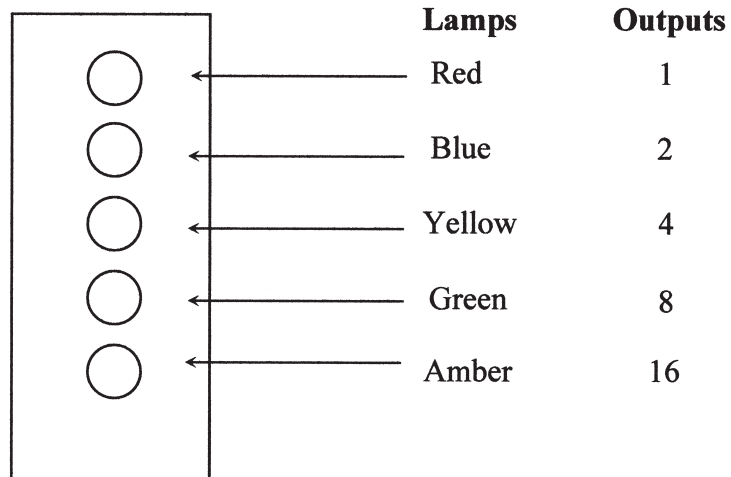


Figure 4

Figure 5 shows part of a flow chart and the layout of the PIC program controlling the lamps.

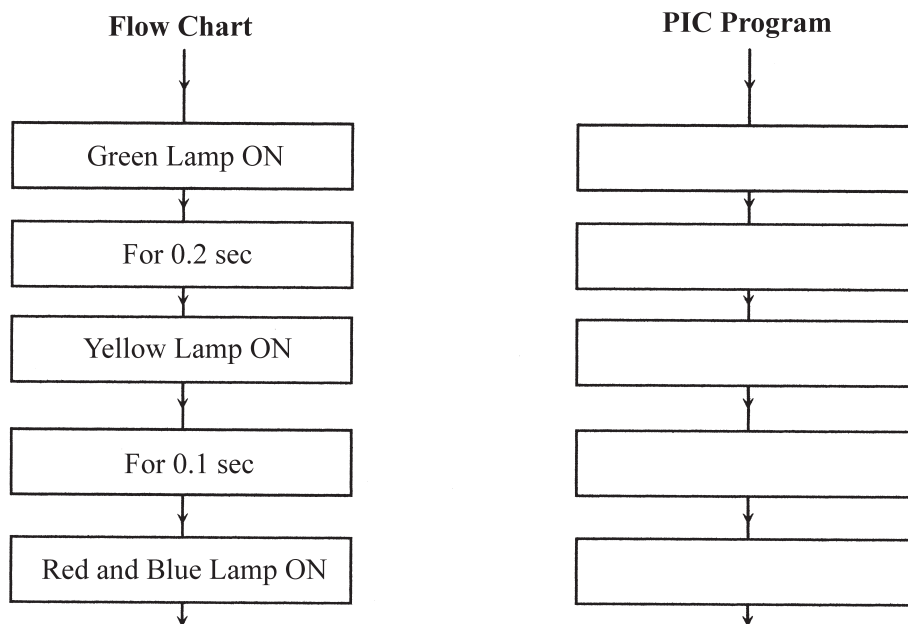


Figure 5

- (a) Complete the program for the part of the flow chart in **Figure 5** using a suitable programming method of your choice. (5 marks)

(b) **Figure 6** shows the lamps connected to the outputs of the PIC microcontroller.

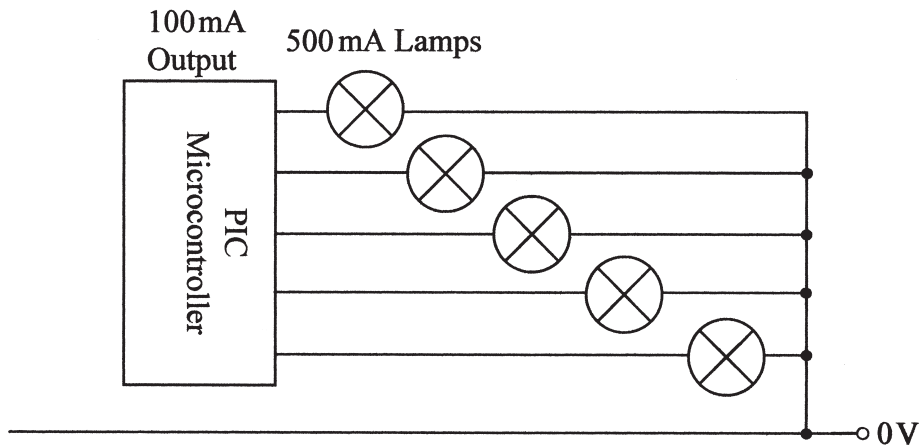


Figure 6

(i) Give the reason for the lamps not working when the circuit was switched on.

.....

(2 marks)

(ii) Complete **Figure 7** by adding suitable interfacing from the middle output, in order to make the lamp work as intended.

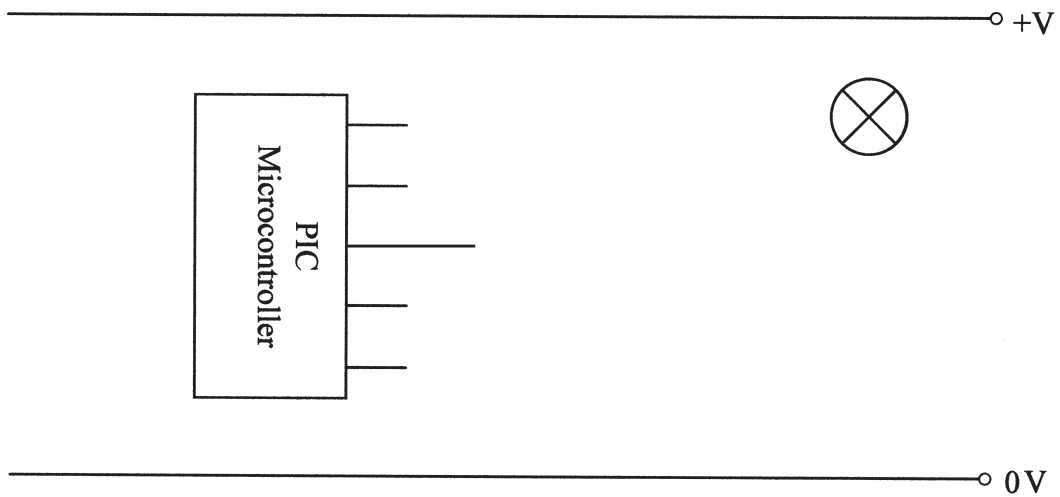


Figure 7

(4 marks)

(iii) Explain why your additions made to the circuit in **Figure 7** would enable the lamp to work when the circuit was switched on.

.....

(2 marks)

Turn over ►

4 The PCB design shown in **Figure 8** is a student's first attempt.

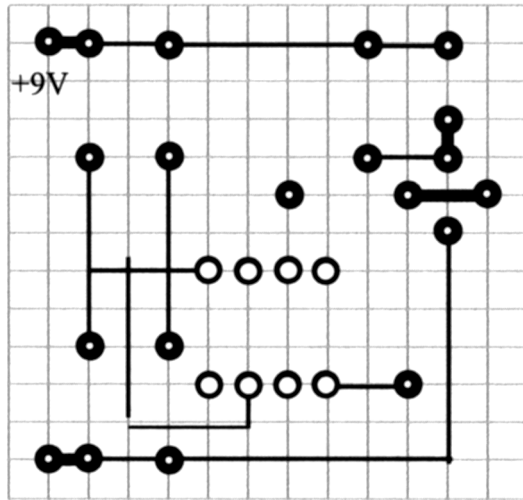


Figure 8

(a) (i) Give **three** changes that would need to be made to the student's first attempt in order to improve the quality of the PCB design.

- 1
- 2
- 3

(3 marks)

(ii) Describe the stages that you would use to change **one** of the problems identified in part (a) (i) when using a PCB CAD program. A starting point has been given.

Drag cursor over correction to be made and left click

-
-
-
-
-
-

(4 marks)

- (b) Complete **Figure 9** by including the details of **two** further stages that would take place in the production of a circuit using veroboard or a PCB.

| | First stage of production |
|----------------------------|--|
| Activity | Mark out and cut the board to size |
| Tools and Equipment | PCB guillotine or bandsaw |
| Health and Safety | Fingers clear of cutter, goggles for bandsaw |
| Quality Issues | Accurate measuring and marking out |



| | Further stage of production |
|----------------------------|------------------------------------|
| Activity | |
| Tools and Equipment | |
| Health and Safety | |
| Quality Issues | |

(4 marks)



| | Further stage of production |
|----------------------------|------------------------------------|
| Activity | |
| Tools and Equipment | |
| Health and Safety | |
| Quality Issues | |

(4 marks)

Figure 9

5 **Figure 10** shows a symbol commonly found on the cases of electronic products and on their packaging.

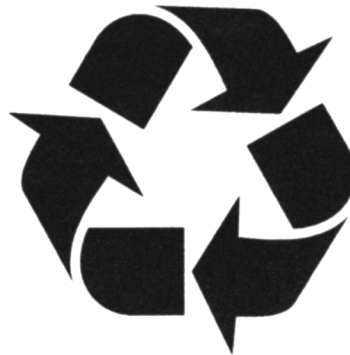


Figure 10

(a) Explain how the use of this symbol could have benefits for the environment.

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

(2 marks)

(b) (i) Give **two** reasons why electronic products are packaged.

1

.....

2

.....

(4 marks)

(ii) Explain some of the problems that the use of packaging has on the environment.

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

(2 marks)

(c) One of the most popular everyday electronic products is the mobile phone.

Explain how the rapid developments made by mobile phone manufacturers have provided both advantages and disadvantages for consumers, society and the environment. The advantages of one may not be used as a disadvantage for another.

(i) **Consumers**

Advantage

Explanation

.....

(3 marks)

Disadvantage

Explanation

.....

(3 marks)

(ii) **Society**

Advantage

Explanation

.....

(3 marks)

Disadvantage

Explanation

.....

(3 marks)

(iii) **The Environment**

Advantage

Explanation

.....

(3 marks)

Disadvantage

Explanation

.....

(3 marks)

END OF QUESTIONS

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