

Candidate Name	Centre Number	Candidate Number



**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**General Certificate of Secondary Education**

**DESIGN AND TECHNOLOGY**  
**(ELECTRONIC PRODUCTS)**

**1953/3**

PAPER 3  
 FOUNDATION TIER

**Specimen Paper 2003**

Additional materials:      Formulae Sheet OCR (Tables 2)

**TIME** 1 hour

**INSTRUCTIONS TO CANDIDATES**

Write your name, Centre number and candidate number in the boxes above.

Answer **all** questions.

Write your answers, in blue or black ink, in the spaces provided on the question paper.

Read each question carefully and make sure you know what you have to do before starting your answer.

Show all your working out for calculations.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets [ ] at the end of each question or part question.

Question 4, Product Analysis, is based on the theme 'Supermarket Checkouts' printed in the specification.

Marks will be awarded for the use of correct conventions.




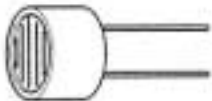
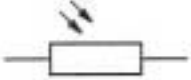
Dimensions are in millimetres unless stated otherwise.

Total marks for this paper is **50**.

Question Number	For Examiner's use only
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	
<b>TOTAL</b>	

1 The table below shows four electronic components.

- (a) Complete the table by naming the component and drawing the circuit symbols. Some have been done for you.

Component Case	Component Name	Circuit Symbol
	resistor	
	LED	
	capacitor	
		

[4]

- (b) Use the formula sheet to work out the value of the resistor.

\_\_\_\_\_

[2]

- (c) Label the positive (anode) lead on the LED.

[1]

**(d)** State the type of capacitor shown in the table.

---

**[1]**

**(e)** Label the positive lead on the capacitor.

**[1]**

**(f)** The component list for an electronic product specifies a capacitor of  $22\mu\text{F}$  16V.  
The capacitor shown in the table would be a suitable replacement.

Explain why this is so.

---

---

**[1]**

- 2 (a) Supermarkets often have cold storage units to display sandwiches etc.  
An electronic alarm uses a flashing LED to give a visual warning if the temperature rises above 5°C.

Fig. 2 shows a block diagram of the system.



Fig 2.

- (i) State two common colours of LEDs.

1 \_\_\_\_\_

2 \_\_\_\_\_

[1]

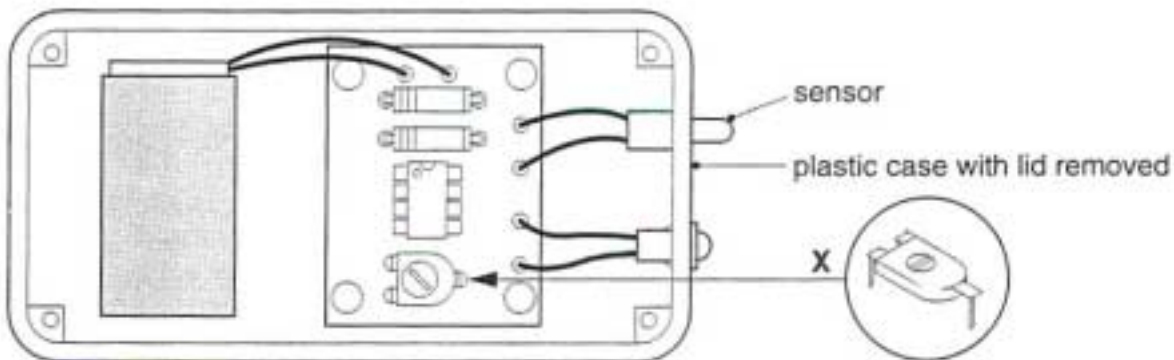
- (ii) State the name of a suitable temperature sensor for the system.

\_\_\_\_\_

[1]

- (b) Fig. 3. shows a prototype of the electronic alarm packaged in a plastic case.

Fig. 3.



- (i) Component X can be adjusted with a screwdriver so that the LED flashes at the required temperature. State the name of component X.

\_\_\_\_\_

[1]

- (ii) Give one reason why it is better to use component X rather than a conventional variable resistor in this particular product.

\_\_\_\_\_

\_\_\_\_\_

[1]

(c) The sensor passes through a hole in the side of the case and is glued in position.

(i) Name a suitable glue for fixing the sensor to the plastic case.

\_\_\_\_\_

[1]

(ii) Draw on Fig. 4. and add notes to show a method of holding the battery in place inside the plastic case.

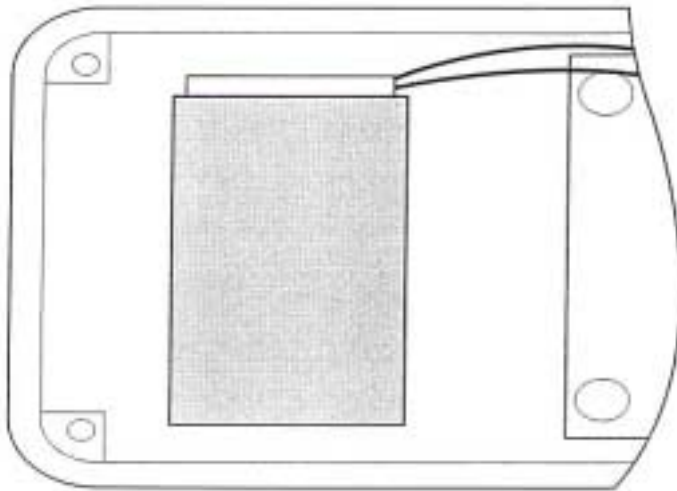


Fig. 4.

[2]

(iii) State two problems associated with the use of batteries for this application.

1 \_\_\_\_\_

[1]

2 \_\_\_\_\_

[1]

(d) It is decided to develop the system further to include a buzzer as well as the flashing LED. Complete on Fig. 5. the output interfacing circuit for the buzzer using a field effect transistor (FET).

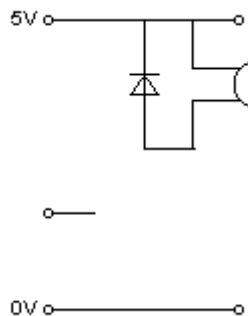


Fig. 5.

[1]

3 Electronic products often use batteries. Fig. 6. shows a small type 23A 12V battery.

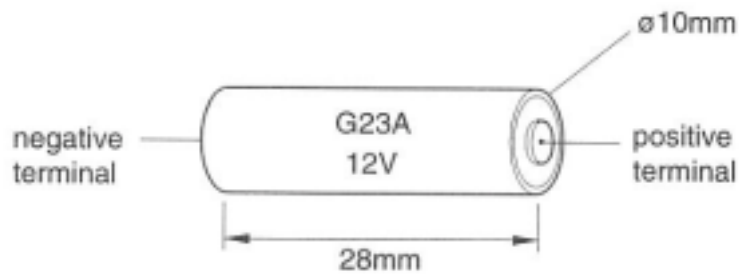
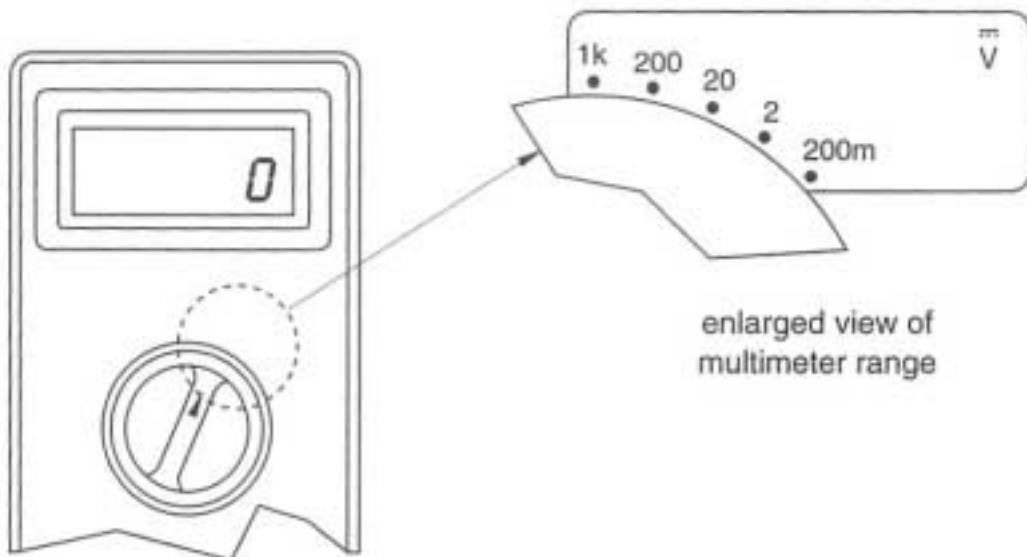


Fig. 6.

- (a) The battery is to be tested using a multimeter. On the enlarged view of the multimeter range shown below, circle the best voltage range for testing this battery.



[1]

- (b) This battery is available in alkaline or zinc carbon dry cells types.  
Give two advantages of an alkaline type when compared to a zinc carbon type.

1 \_\_\_\_\_ [1]

2 \_\_\_\_\_ [1]

- (c) A self contained freezer alarm uses an astable circuit to flash three warning LEDs when the alarm is armed.

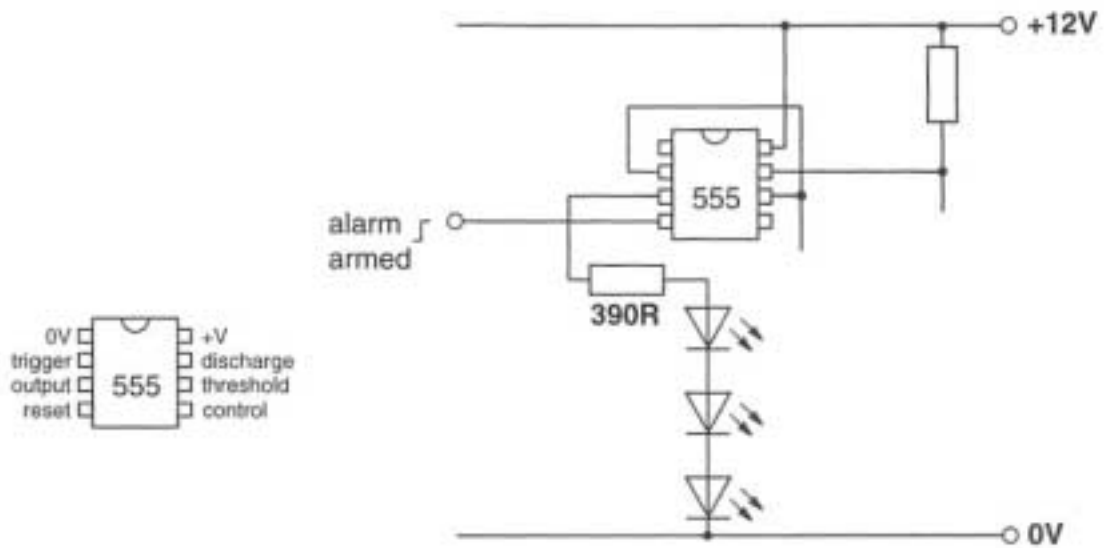


Fig. 7.

- (i) Complete the astable circuit shown in Fig. 7. [4]

- (ii) The high level output from the astable is 12V. Each LED has a voltage drop of 2V.

Calculate the current flowing through the LEDs when they are all lit.

---



---



---

[2]

- (d) State one disadvantage of using a battery to power this type of alarm.

---

[1]

**Product Evaluation Question**

4 (a) Supermarket checkouts often have an automatic conveyer belt to move goods towards the cashier. The belt stops when a light beam is broken.

(i) Name a suitable electronic sensor to detect when the light beam is broken.

\_\_\_\_\_ [1]

The sensor is usually placed in a tube. Fig. 7(a) and 7(b) show possible arrangements.



**Fig. 7(a)**



**Fig. 7(b)**

(ii) Give one reason why the arrangement shown in Fig. 7(a) is better than that shown in Fig. 7(b)

\_\_\_\_\_ [1]

(b) Barcode readers are used to enter information into the electronic cash register. Describe two ways in which this information can be used.

1 \_\_\_\_\_ [1]

2 \_\_\_\_\_ [1]



(c) Electronic cash registers can use seven segment LED or LCD displays to show the amount entered.

(i) State what the letters LCD stand for.

\_\_\_\_\_ [1]

Matrix displays made up of LEDs as shown in Fig. X. can also be used in electronic cash registers

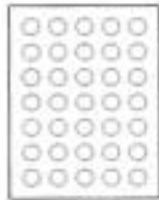


Fig. 8.

(ii) State one advantage of this type of display over LCD displays.

\_\_\_\_\_ [1]

Matrix displays are often positioned side by side. Multiple matrix displays can be multiplexed together as shown by Fig. 9.

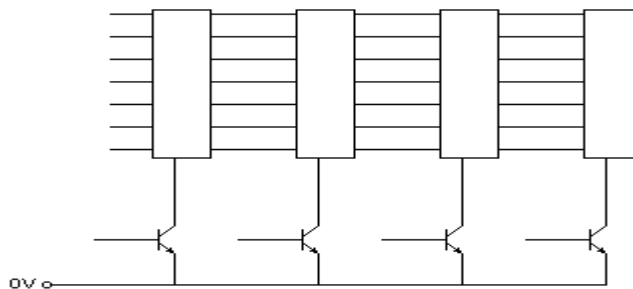


Fig 9

(iii) Describe what is meant by the term 'multiplexing'.

\_\_\_\_\_ [1]

(iv) Name a suitable single IC that could provide the four transistor drivers required.

\_\_\_\_\_ [1]

[Question 4 continued on the next page]

- (d)** A microcontroller is often used to provide the control for a multiplexer circuit. State two reasons why a microcontroller is suitable for use in this type of application.

1 \_\_\_\_\_ [1]

2 \_\_\_\_\_ [1]

- 5 (a) Fig. 10. shows a diagram of a toggle switch. The switch is to be mounted on a front panel made from sheet aluminium. The shape of the panel cutout required for the switch is also shown.

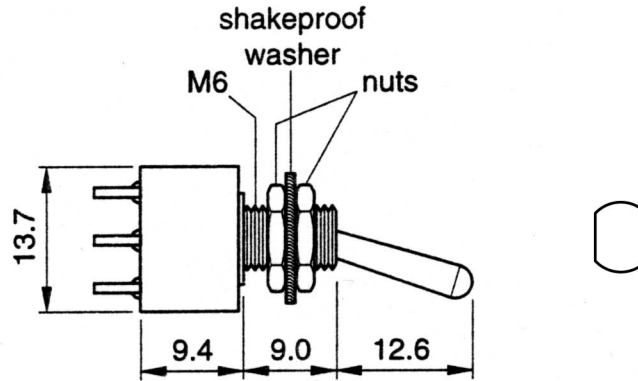


Fig. 10.

- (i) State the maximum thickness of sheet aluminium that the switch could be securely mounted onto.

---

[1]

Ten identical prototype front panels are to be produced for market testing of the product.

- (ii) Name this type of production method.

---

[1]

- (iii) Explain how CAD and CAM could be used to design and manufacture the prototype panels.

---



---



---



---



---



---

[4]

[Question 5 continued on the next page]

**(b)** To avoid the cost of designing and printing a separate self-adhesive sticker for the prototype panels, the switch labels and instructions are to be engraved directly onto the aluminium panel.

**(i)** Describe how the engraving could be made more attractive and visible.

---

---

**[2]**

**(ii)** State two environmental reasons why it is preferable to manufacture prototype panels out of aluminium rather than steel.

1 \_\_\_\_\_

**[1]**

2 \_\_\_\_\_

**[1]**

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**General Certificate of Secondary Education**

**DESIGN AND TECHNOLOGY  
(ELECTRONIC PRODUCTS)**

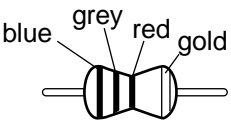
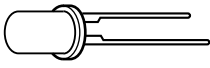
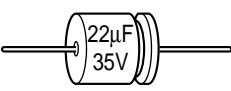
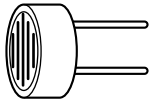
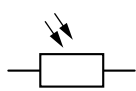
**1953/3**

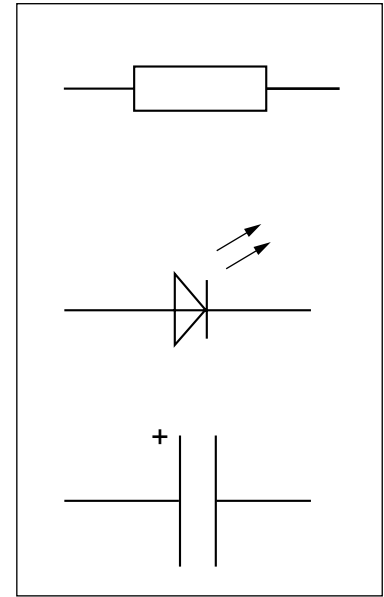
**PAPER 3 FOUNDATION TIER**

**MARK SCHEME**

**Specimen Paper 2003**

1 (a)

Component Case	Component Name	Circuit Symbol
	resistor	
	LED	
	capacitor	
		



Light dependent resistor or LDR

[4]

(b) 6800

W

or 6.8 kW

1 mark for value, 1 mark for unit.

[2]

(c) Label the positive (anode) lead on the LED. This is the long leg

[1]

(d) Electrolytic

[1]

(e) Label the positive lead on the capacitor. Positive lead is near ring (Right hand side of the capacitor drawn in the table.)

[1]

(f) The component list for an electronic product specifies a capacitor of 22µF 16V. The capacitor shown in the table would be a suitable replacement. Explain why this is so.

The labelling on the capacitor indicates the maximum working value. This value is less as 16V is less than 35V.

[1]

[Total : 10]

- 2 (a) (i) State two common colours: red, green and yellow (or blue) (any two) [1]
- (ii) Suitable sensor: thermistor or temperature dependent resistor [1]
- (b) (i) Component X: preset resistor [1]
- (ii) Give one reason why it is better to use component X rather than a conventional variable resistor in this particular product.

The resistor has a pre-determined range which is narrower than a variable resistor and thus protects other components/smaller size. [1]

- (c) (i) Name a suitable glue for fixing the sensor to the plastic case.

Epoxy resin [1]

- (ii) Draw on Fig. 4. and add notes to show a method of holding the battery in place inside the plastic case.

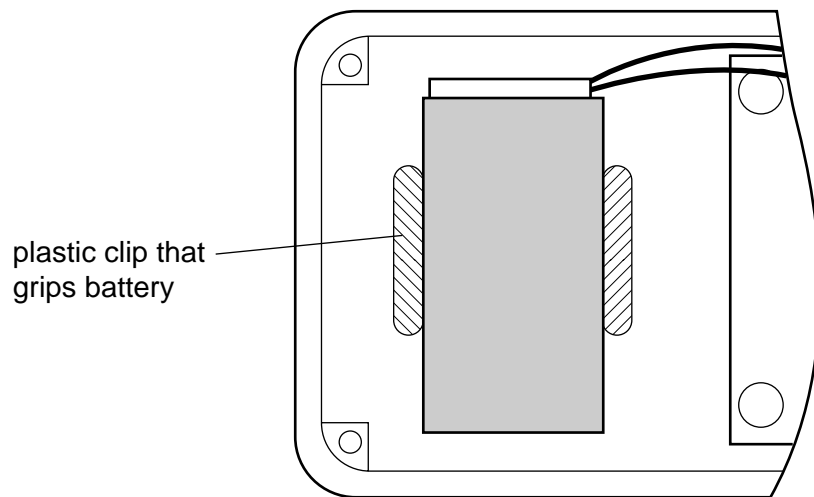


Fig. 4

Drawing

Notes

1 mark each.

[2]

- (iii) State two problems associated with the use of batteries for this application.

Any two from

1 the large size/volume

2 the large weight

3 temperature may be too low

1 mark each.

[2]

- (d) It is decided to develop the system further to include a buzzer as well as the flashing LED. Complete on Fig. 5. the output interfacing circuit for the buzzer using a field effect transistor (FET).

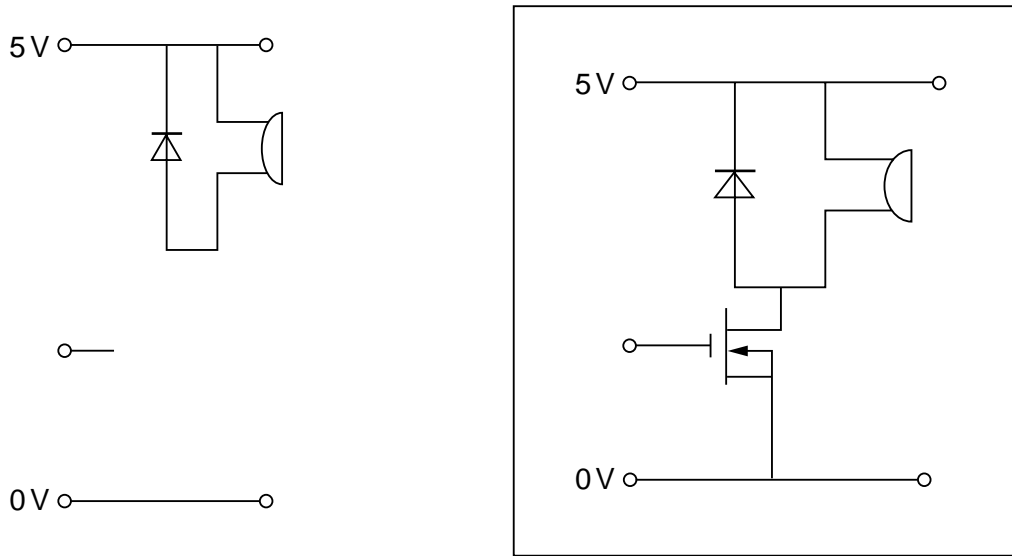


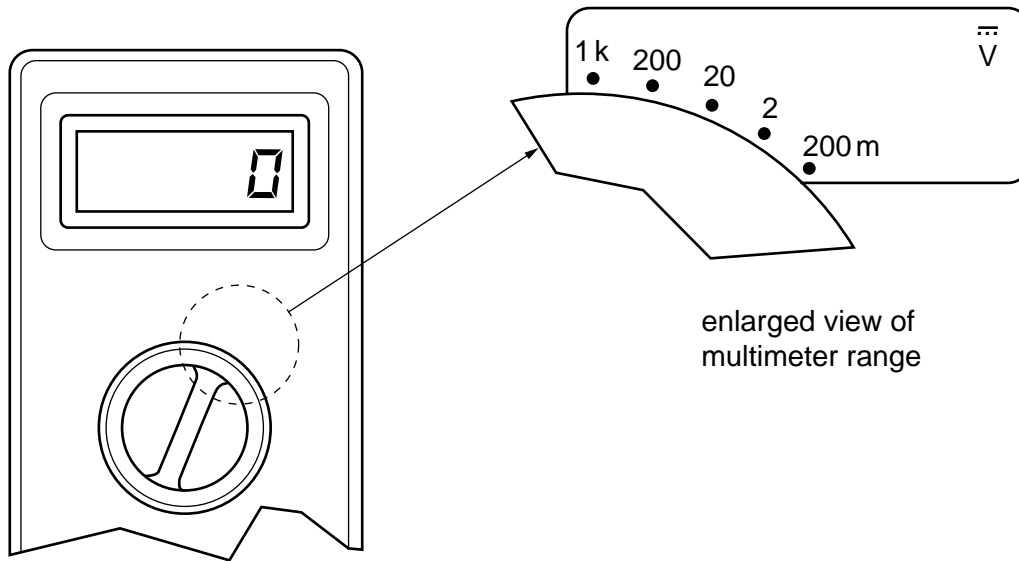
Fig. 5

[1]

[Total : 10]



- 3 (a) The battery is to be tested using a multimeter. On the enlarged view of the multimeter range shown below, circle the best voltage range for testing this battery.



20 should be circled

[1]

- (b) Give two advantages of an alkaline type when compared to a zinc carbon type.

Any two from

- 1 have a higher capacity
  - 2 the voltage level does not fall so quickly
  - 3 better in voltage dependent circuits
- 1 mark each.

[2]

- (c) A self contained freezer alarm uses an astable circuit to flash three warning LEDs when the alarm is armed.

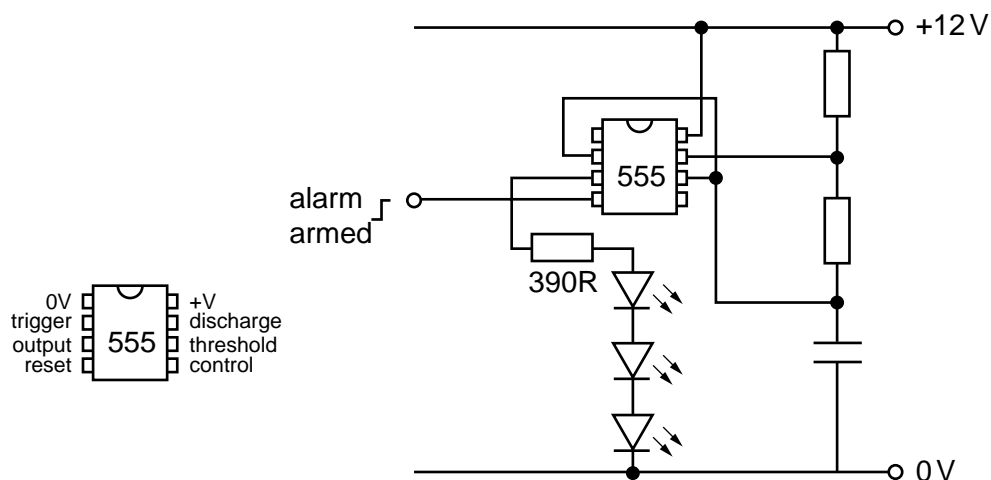


Fig. 7

- (i) Complete the astable circuit shown in Fig. 7. [4]

- (ii) 6 V drop across LEDs, 6 V drop across 390 R

$$V = I \times R \quad I = V/R = 6/390$$

$$= 0.015 \text{ A (15 mA)}$$

- 1 mark for substituting in formula and 1 mark for answer. [2]

- (d) Disadvantage: weight/size or space/cold [1]

[Total : 10]

## Product Analysis Question

- 4 (a) (i) Suitable sensor: light dependent resistor/LDR [1]
- (ii) Arrangement (a) is better because less chance of stray light entering [1]
- (b) Use information gathered by a barcode reader
- Any two from
- 1 keeps a record of stock
  - 2 records replacement needs
  - 3 records cash flow
- 1 mark each. [2]
- (c) (i) Liquid Crystal Display [1]
- (ii) Advantage of matrix displays of LEDs over LCD displays:
- Visible in dark, large size possible [1]
- (iii) 'multiplexing'.
- Is a method of reducing the number of connections (wires)
- by replacing a lot of outputs by combining signals [1]
- (iv) Name a suitable single IC that could provide the four transistor drivers required.
- ULN 2003 A/ ULN 2803 A [1]
- (d) State two reasons why a microcontroller is suitable for use in this type of application.
- 1 Easily re-programmed to display new numbers [1]
  - 2 Enough input/output pins to control all lines [1]

**[Total : 10]**

- 5 (a) (i) 5 mm [1]
- (ii) Type of production method : batch [1]
- (iii) CAD would be used to design the shape and dimensions of the cutouts, as well as enabling the designer to easily change design (e.g. move switch position).
- CAM would be used to automatically cut out the design e.g. with a CNC punch or milling machine. [4]
- (b) (i) Describe how the engraving could be made more attractive and visible.
- The engraving could be inked to provide a higher contrast between the letters and surrounding metal [2]
- (ii) State two environmental reasons why it is preferable to manufacture prototype panels out of aluminium rather than steel.
- 1 Aluminium is easily melted down and recycled [1]
- 2 Easily worked and so reduce wear on machines and power machines and power required for machining [1]
- [Total : 10]