

GENERAL CERTIFICATE OF SECONDARY EDUCATION

DESIGN AND TECHNOLOGY

1953/01

Electronic Products

Full Course

Paper 1 (Foundation Tier)

Candidates answer on the Question Paper

OCR Supplied Materials:

None

Other Materials Required:

None

Wednesday 26 May 2010

Afternoon

Duration: 1 hour



Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).
- Show all working for calculations.
- All necessary formulae are provided within the questions. No extra formulae sheet is required.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **50**.
- Marks will be awarded for the use of correct conventions.
- Dimensions are in mm unless stated otherwise.
- This document consists of **16** pages. Any blank pages are indicated.

2

- 1 It is essential to fit components correctly in an electronic circuit.
Fig. 1 shows five components that have to be fitted the correct way round in a circuit.

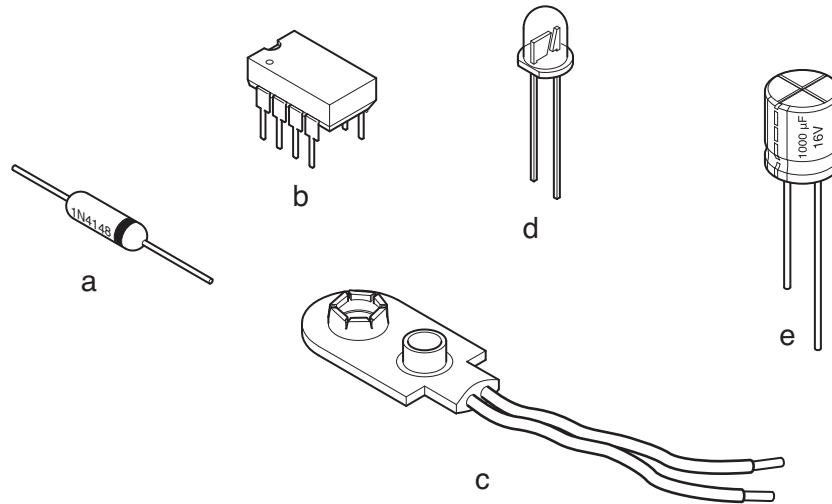


Fig. 1

- (a) (i) Complete the table below to show how each component can be correctly placed. One has been completed for you.

feature on component	component
flat to show negative end	d
colour coded	
coloured band at one end	
notch or dot at pin 1 end	
negative leg is shorter	

[4]

- (ii) Fig. 2 shows the information on the side of component **e** from Fig. 1. Give the meaning of each piece of information.

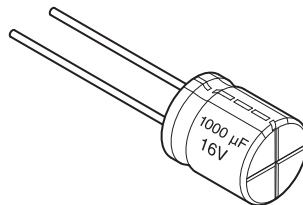


Fig. 2

1000 μF [1]

16V [1]

- (b) Circuit symbols are often printed on the top of a circuit board to show the position of a component.

(i) Mark the correct hole for leg **X** on Fig. 3.

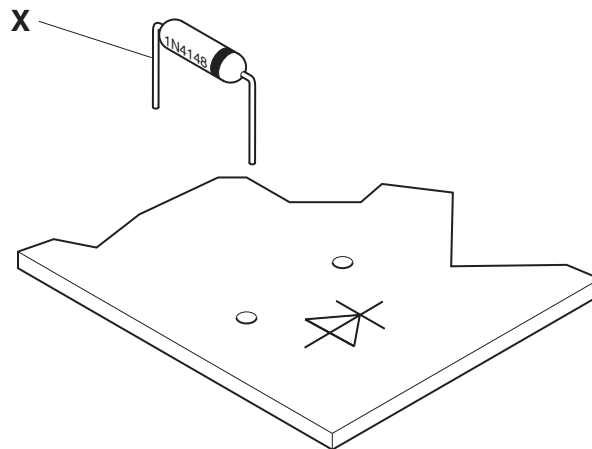


Fig. 3

[1]

- (ii) Give **one** possible result of operating the circuit with this component the wrong way round.

..... [1]

- (c) An IC holder is shown in Fig. 4.

Describe **two** benefits of using the holder rather than soldering an IC directly to a circuit board.

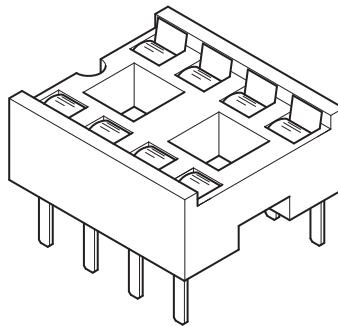


Fig. 4

Benefit 1 [1]

Benefit 2 [1]

[Total: 10]

- 2 A sensor for a greenhouse frost monitor is to be tested.
Fig. 5 shows an NTC thermistor being tested with a multimeter.

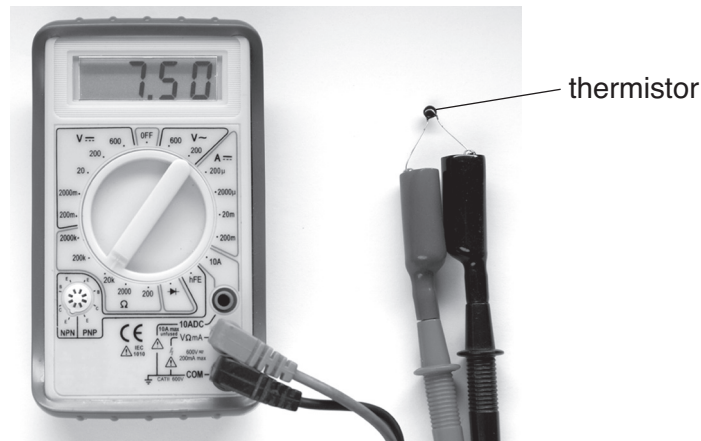


Fig. 5

- (a) (i) Describe what will happen to the reading if the thermistor is placed on a bag of ice.

..... [1]

- (ii) The comparator circuit for the frost monitor is shown in Fig. 6.
State the purpose of the resistors VR1 and R3.

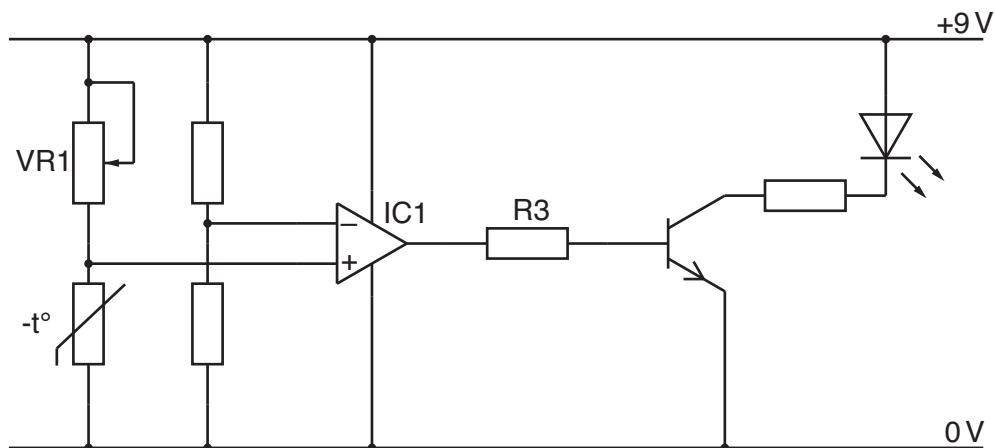


Fig. 6

Purpose of VR1 [1]

Purpose of R3 [1]

- (b) Fig. 7 shows the circuit symbol for IC1 next to the pin diagram.
Complete the pin numbers for each connection on the circuit symbol.

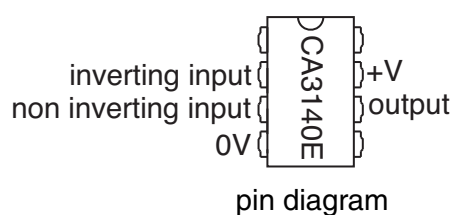
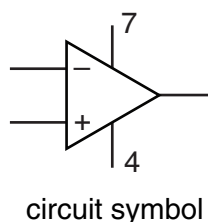


Fig. 7

[3]

- (c) Fig. 8 shows part of the solder side of the circuit board for the frost monitor. There are two faults visible on the soldering. State how each fault can be corrected.

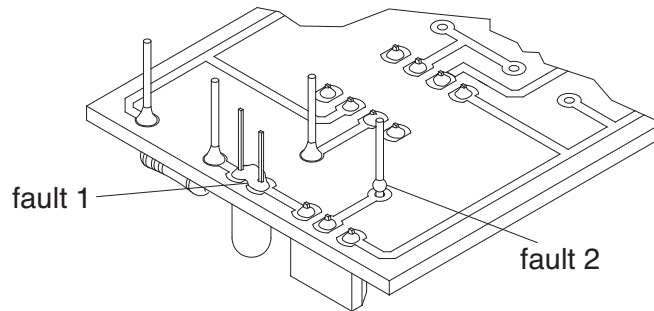


Fig. 8

Fault 1
 [1]

Fault 2
 [1]

- (d) Fig. 9 shows a close up view of a piece of multicore solder with the flux visible.

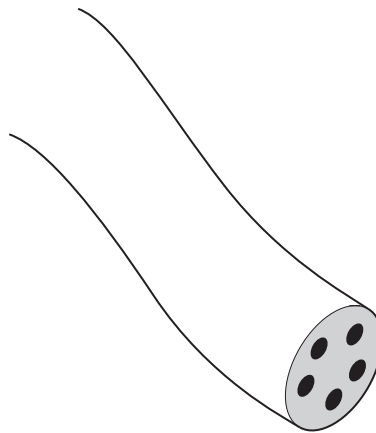


Fig. 9

(i) State the purpose of flux in solder.
 [1]

(ii) State the name of the metal that is no longer used in solder for commercial circuit manufacture.
 [1]

[Total: 10]

- 3 A simple alarm system for a garden shed uses a pressure pad to operate a latch in the circuit. The latch is reset with a key switch. Fig. 10 shows the latching part of the circuit and the truth table for the logic gate used.

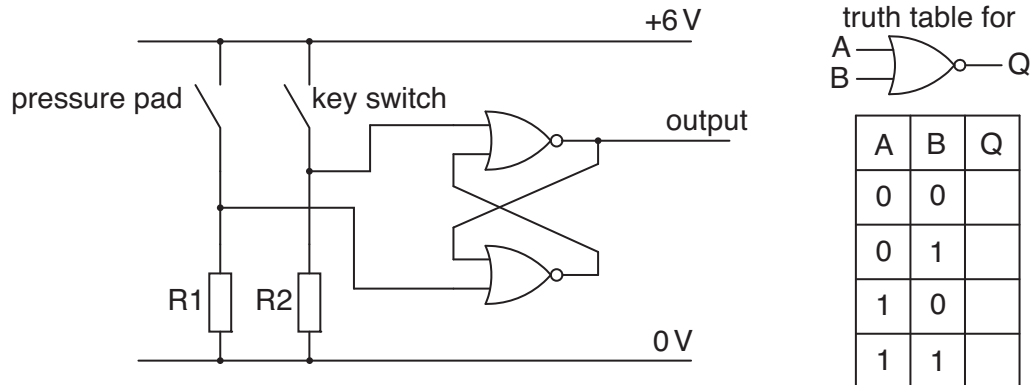


Fig. 10

- (a) (i) State the type of logic gate used in the system.

..... [1]

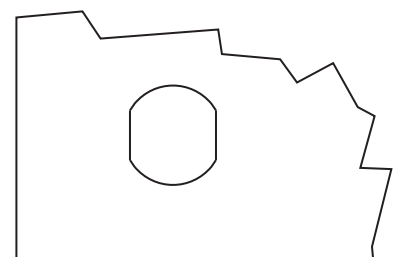
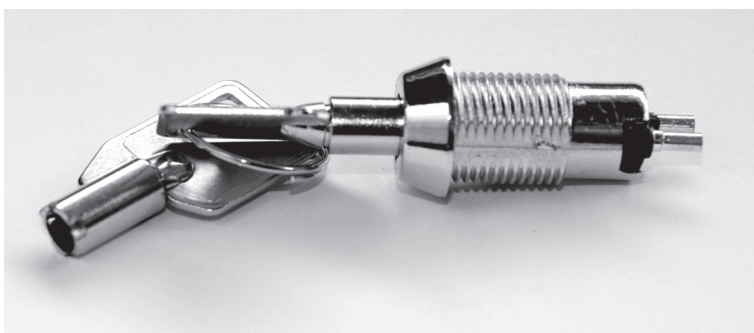
- (ii) Complete the truth table in Fig. 10 for the logic gate used.

[1]

- (iii) Resistors R1 and R2 are known as pull down resistors. Give the reason why they are essential in the circuit.

..... [1]

- (b) The key switch used to reset the circuit requires a shaped hole in the casing as shown in Fig. 11.



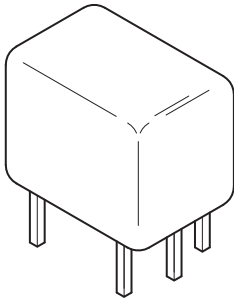
shaped hole for key switch

Fig. 11

Give the reason for **not** using a round hole.

..... [1]

- (c) A relay will be used to operate a siren.
Catalogue details of the relay chosen are shown in Fig. 12.



temperature range	−40 °C to +85 °C
contact rating	10 A 250VDC
coil voltage	6V
coil consumption	360mW
operating time	10mS
release time	5mS

Fig. 12

- (i) Calculate the current flow through the relay coil.
Use the formula $P = V \times I$.

.....

 [2]

- (ii) Give **two** benefits of using a relay to operate the siren.

Benefit 1 [1]

Benefit 2 [1]

- (iii) Complete Fig. 13 to show the operating circuit for the relay coil.

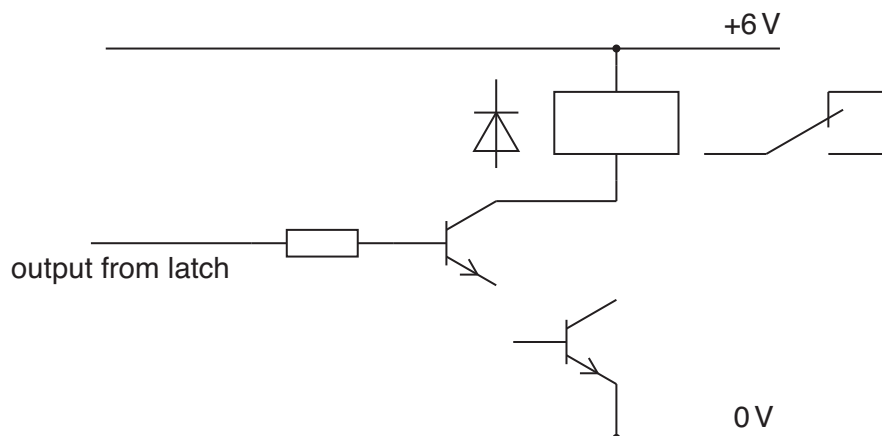


Fig. 13

[2]

[Total: 10]

- 4 Electronic product cases normally need holes drilling so that switches and external components can be fitted.
2D CAD software has been used to draw a drill template.

(a) State **two** benefits of using CAD for the drill template design rather than drawing it by hand.

Benefit 1 [1]

Benefit 2 [1]

(b) Holes to match those in a PCB are included in the CAD drawing of a template shown in Fig. 14.

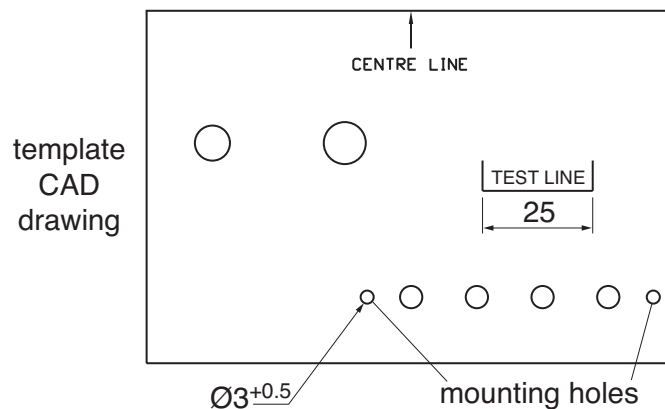


Fig. 14

The diameter of the mounting holes for the PCB is shown on the drawing as $\text{Ø}3^{+0.5}$, giving a tolerance of +0.5 mm.

Give the likely reason for allowing a tolerance on the hole diameter.

Reason [1]

(c) Output from the CAD drawing can be printed as a paper template. It can also be used in a laser cutter for production of an acrylic template.
Fig. 15 shows both outputs.

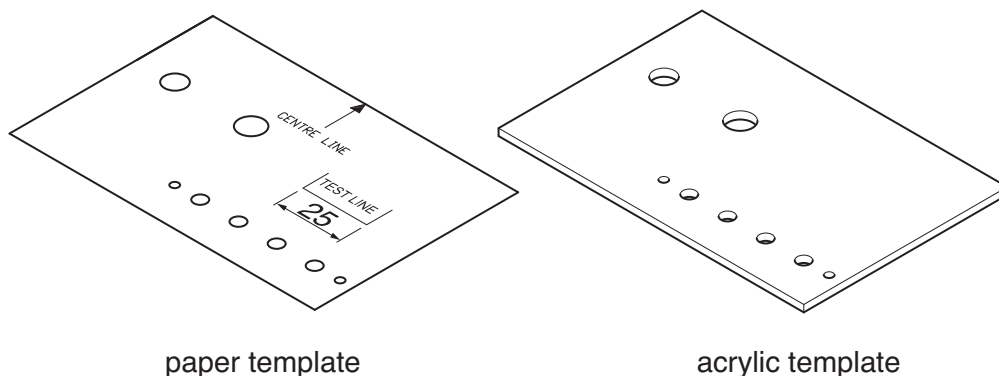


Fig. 15

(i) Give **one** method of checking the accuracy of the paper template before use.

..... [1]

- (ii) Explain why the laser cut template is likely to be more accurate in use than the paper template.

.....

 [2]

- (iii) Fig. 16 shows the laser cut template and the case lid that is to be drilled.

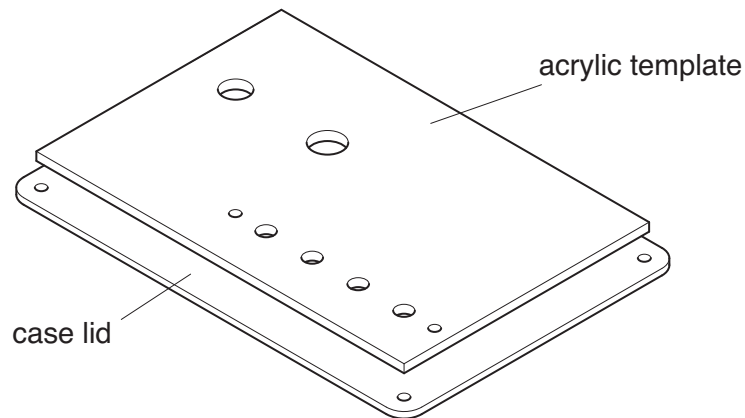


Fig. 16

Use notes or sketches to show a method of accurately securing the acrylic template to ensure that all the holes line up.

[2]

- (d) It should be possible to recycle the materials when an electronic product is no longer required.

Give **two** pieces of information that should be included on the case to make recycling easier.

1 [1]

2 [1]

[Total: 10]

Turn over

- 5 Fig. 17 shows a hand held detector used for finding concealed mains cable, other metals and timber framing. The device is powered by a 9V battery and includes a white LED torch.

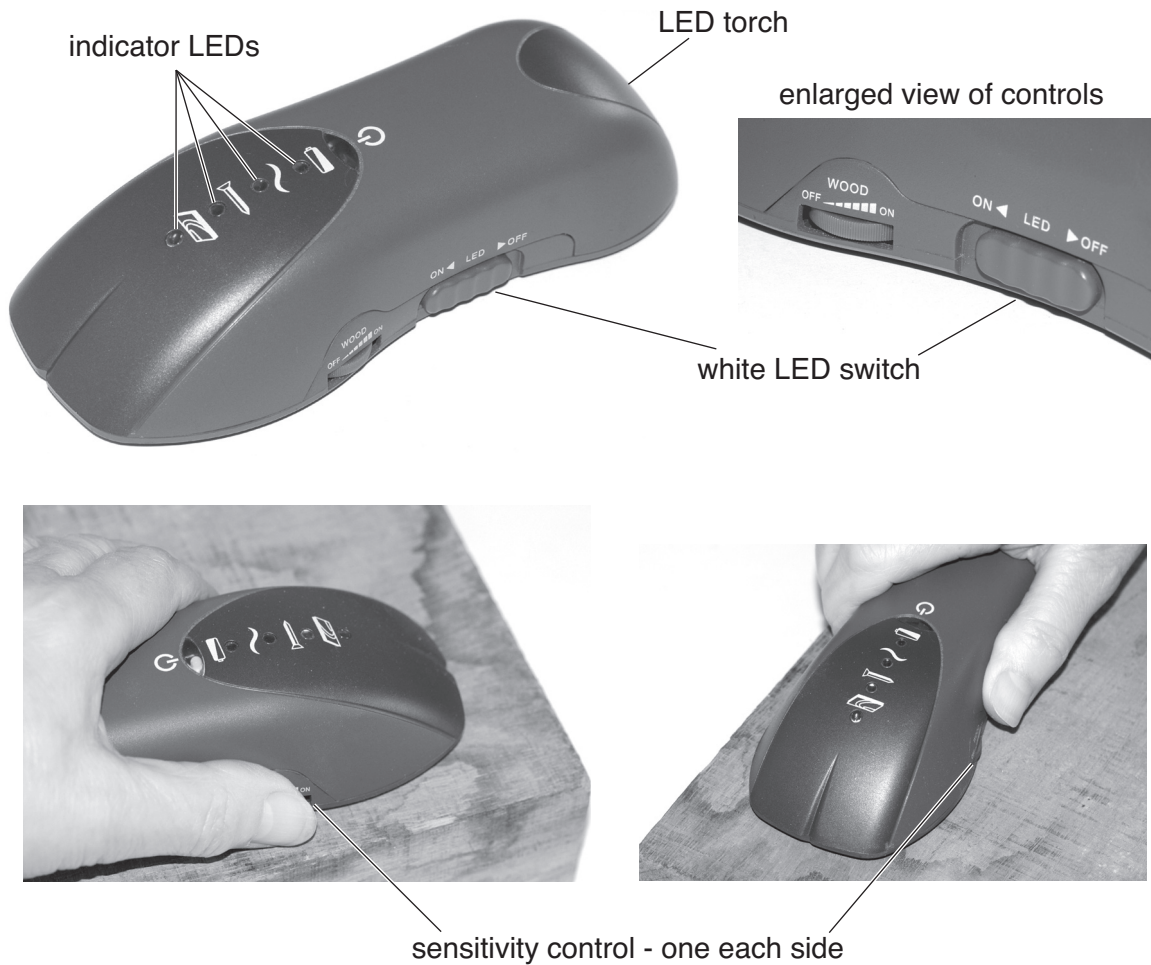


Fig. 17

(a) Give **two** factors that contribute to the ergonomic design of the detector.

- 1 [1]
- 2 [1]

- (b) The case is injection moulded. The base is held in place by self tapping screws as shown in Fig. 18.



Fig. 18

- (i) Give **one** reason for using self tapping screws to secure the base during manufacture.

.....
 [1]

- (ii) State why the symbols next to the indicator LEDs and controls in Fig. 17 must have been applied after the moulding had taken place.

.....
 [1]

- (c) Fig. 19 shows a view of the circuit board.

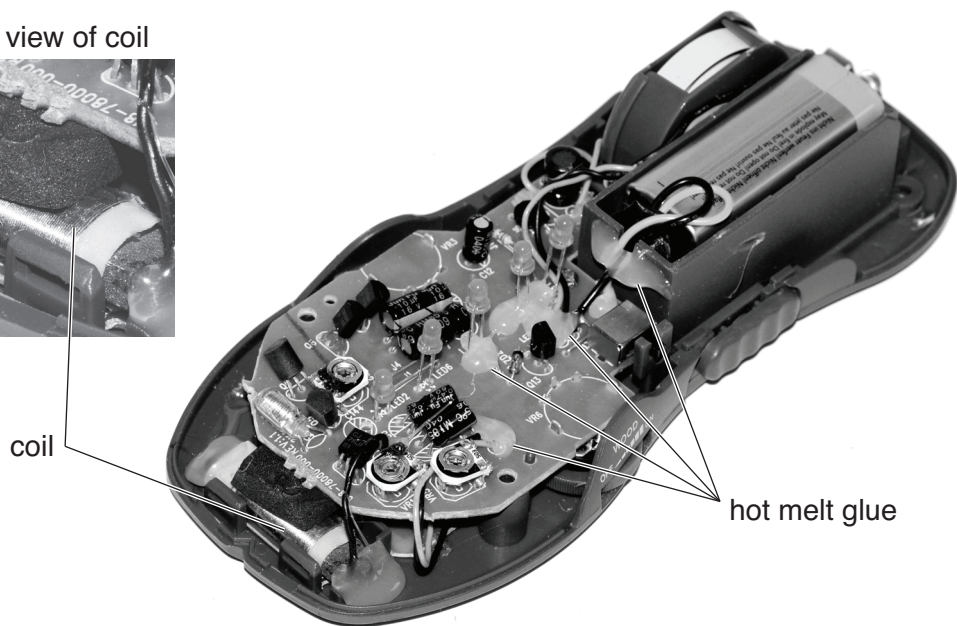
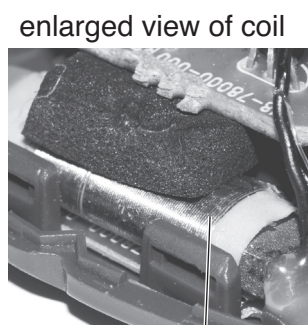


Fig. 19

- (i) Give **one** reason for holding in place connecting wires with hot melt glue.

..... [1]

- (ii) The sensor for the detector uses enameled copper wire in a coil.
 State **one** reason for the use of enamel on the copper wire.

.....
 [1]

- (d) Fig. 20 shows the LED indicators on the circuit board. The LEDs have been soldered into position at varying heights to match the curve of the case.

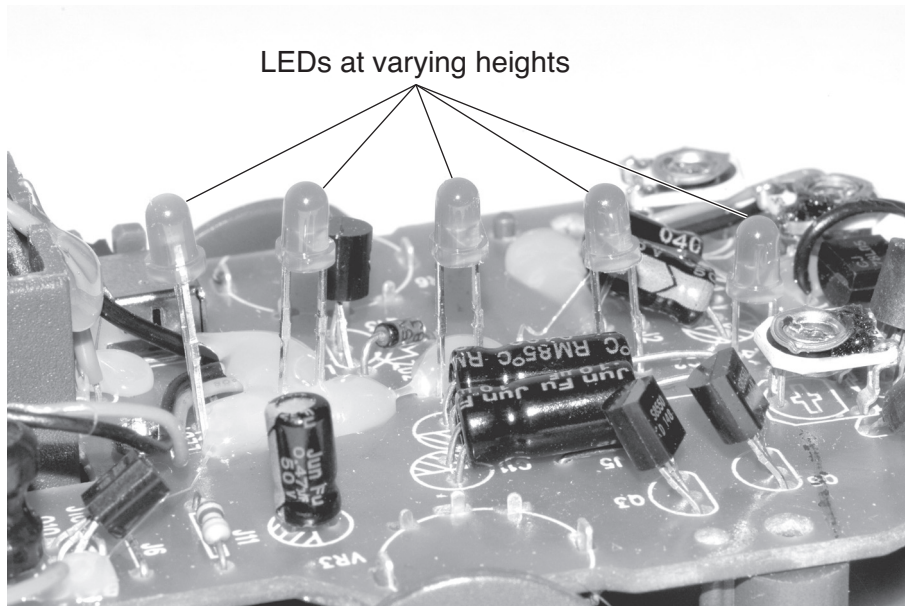


Fig. 20

- (i) Use notes or sketches to describe how the LED heights could be accurately controlled when assembling a batch of boards.

- (ii) Fig. 21 shows two radial capacitors on the circuit board, bent to a horizontal position.

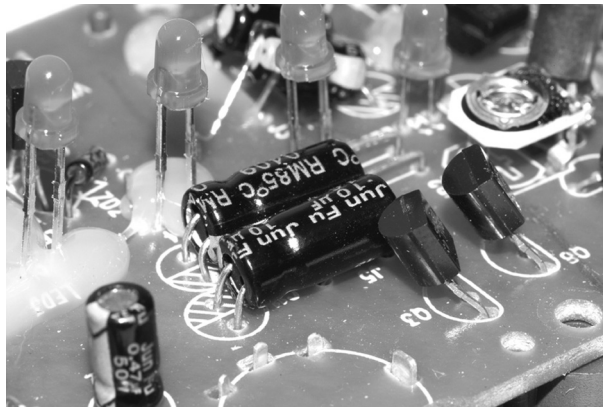


Fig. 21

Explain why it may be better to use either shorter radial capacitors or axial capacitors.

.....

.....

..... [2]

[Total: 10]

14
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

15
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.