OCR
RECOGNISING ACHIEVEMENT

Monday 28 January 2013 – Morning

GCSE DESIGN AND TECHNOLOGY
Electronics and Control Systems

A514/01 Technical Aspects of Designing and Making: Electronics

A528620113

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- A calculator may be used

Duration: 1 hour 15 minutes

A514010

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions in **Section A and Section B**.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- 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 your working out for calculations.
- Do **not** write in the bar codes.

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 **60**.
- Marks will be awarded for the use of correct conventions.
- Your Quality of Written Communication will be assessed in questions marked with an asterisk (*).
- Dimensions are in millimetres unless stated otherwise.
- This document consists of **16** pages. Any blank pages are indicated.

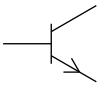
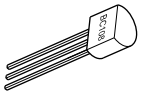
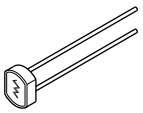
A calculator may be used for this paper

OCR is an exempt Charity

SECTION A

Answer **all** questions.

1 **(a)** Fig. 1 shows details of electronic components.
Complete the table in Fig. 1 by adding the missing information.

Name	Symbol	Shape
		
diode		
LDR		

[3]

Fig. 1

(b) **(i)** The list below shows stages in the making of a circuit board.
Place the stages in the correct order. The first one has been done for you.

design PCB **add components** **design circuit**

drill holes in PCB **manufacture PCB**

Stage 1 Design circuit .....

Stage 2 .....

Stage 3 .....

Stage 4 .....

Stage 5 .....

[3]

(ii) One stage that has been missed out from the list is 'ordering components'.
Explain why this stage does not have a set position in the order.

.....

.....

..... **[2]**

(iii) When buying solder it will often be supplied with a COSHH information sheet. Explain the purpose of this information sheet.

.....

.....

..... **[2]**

(c) Fig. 2 shows views of a joint between a spade terminal and a switch.

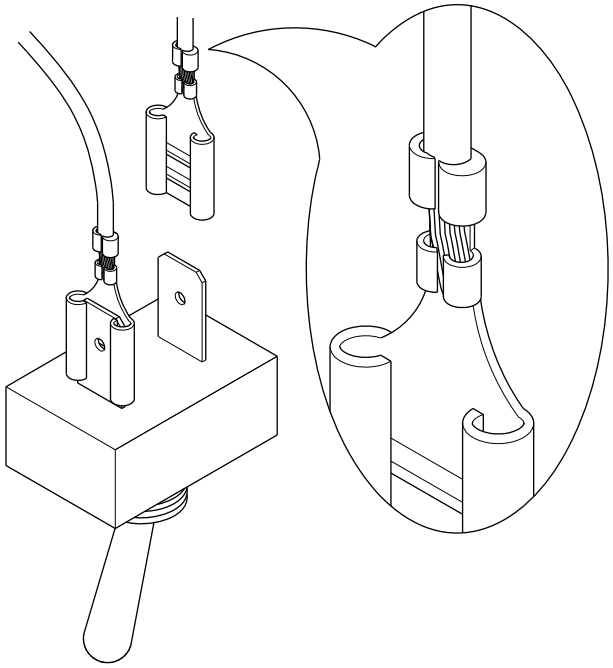


Fig. 2

Name **two** tools that will be needed to connect the wire to the spade terminal at the point shown in the enlarged view.

1 .....

2 .....

[2]

[Total: 12]

2 Fig. 3 shows views of an infra red (IR) remote controller for a TV or DVD player.

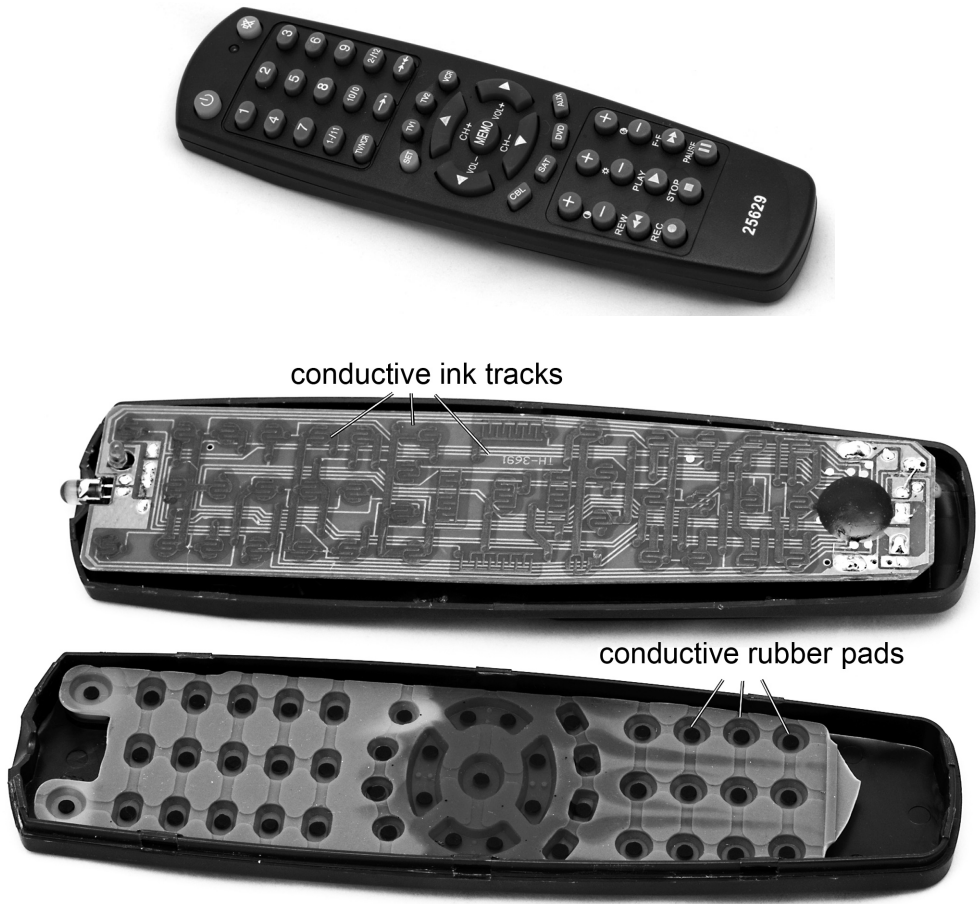


Fig. 3

(a) When a button on the remote controller is pressed the conductive rubber pad under the button will connect two points on a track.

Give **three** benefits of using this type of switch.

1 .....

2 .....

3 .....

[3]

(b) The Chip on Board (COB) IC shown in Fig. 4 is encased in epoxy resin.

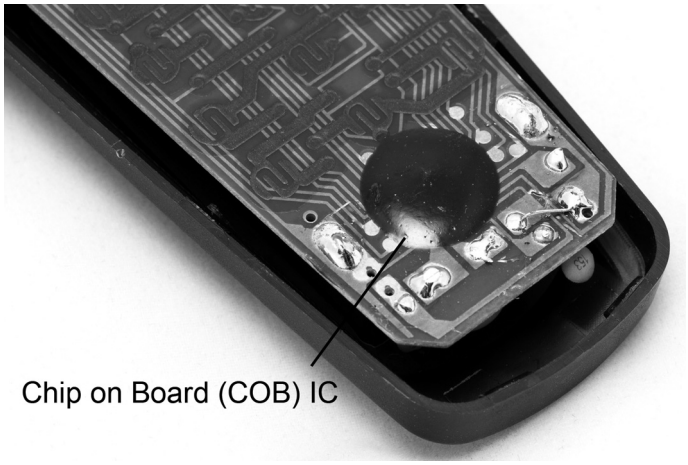


Fig. 4

Give **two** properties of epoxy resin that make it suitable for encasing electronic components.

1 .....

2 .....

[2]

(c) The LED shown in Fig. 5 is used to indicate when a button has been pressed.

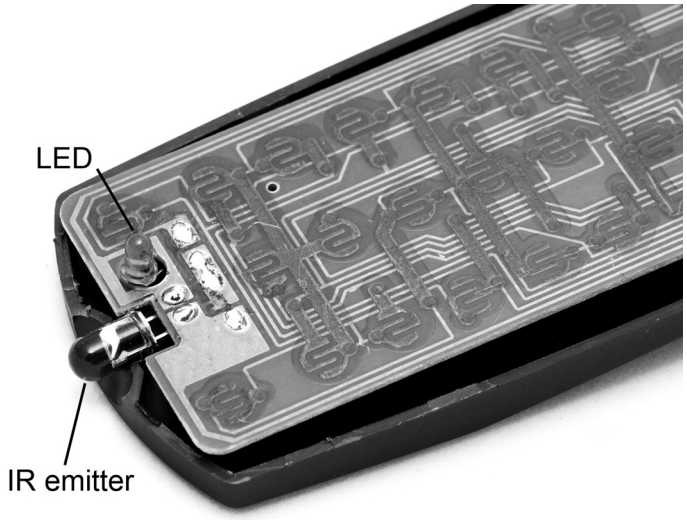


Fig. 5

State the reason why the IR emitter will not indicate when a button has been pressed.

..... **[1]**

(d)* The risk of injury when using machines in a workshop can be reduced in a number of ways. Discuss why the following safety measures are **not** always successful.

- Use of personal protective equipment (PPE)
- Guarding of individual machines
- Training for users of the machines.

Marks will be awarded for the quality of written communication in your answer.

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..... **[6]**

[Total: 12]

3 **(a)** Fig. 6 shows two CAD views of a box to house a small amplifier.
The parts of the box are to be laser cut from acrylic.

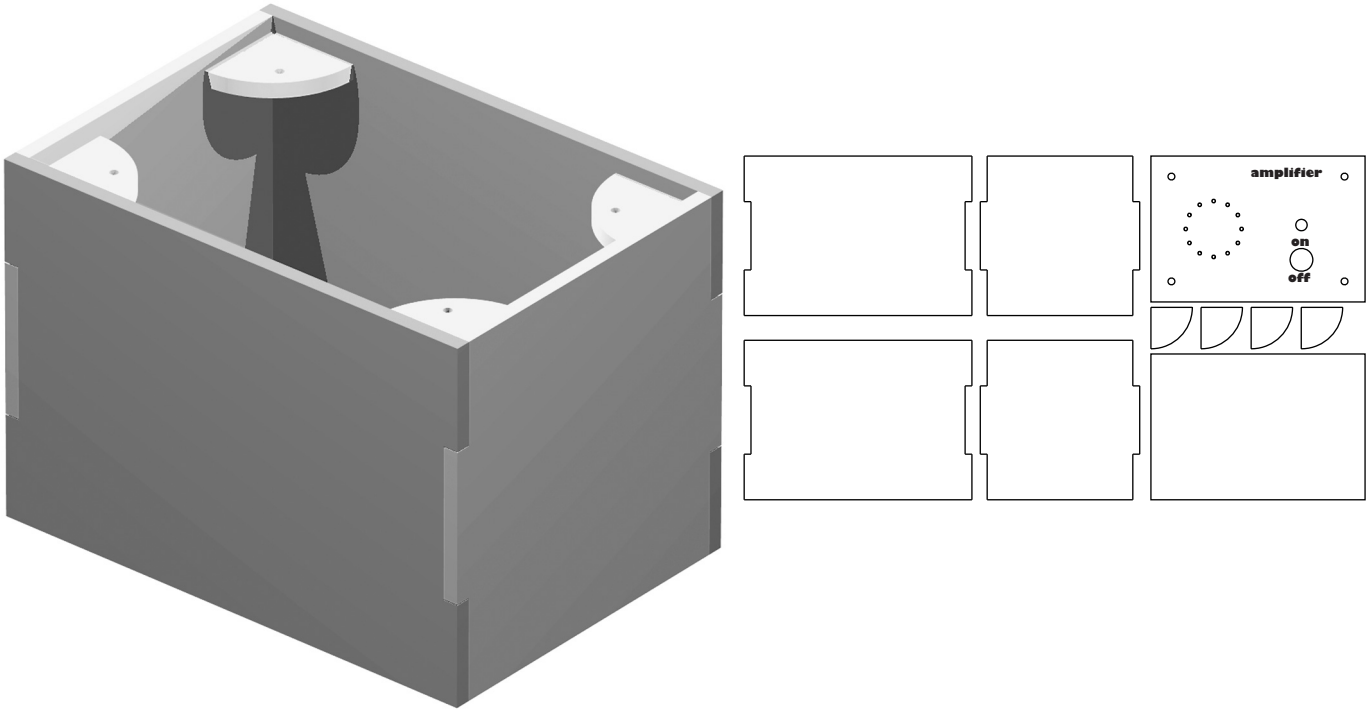


Fig. 6

(i) Give **one** reason for producing a 3D view when designing the box.

..... **[1]**

(ii) Give **one** reason for producing the 2D drawing.

..... **[1]**

(iii) The holes shown in the top could be drilled or they could be laser cut.
Explain why laser cutting the holes is a better method.

.....

.....

..... **[2]**

(iv) The parts of the box will be joined using a solvent cement.
State **one** precaution that should be taken when using a solvent cement to join acrylic.

..... **[1]**

(b) An alternative method of producing a project case is to use vacuum forming.
Give **two** advantages of vacuum forming compared to the method shown in Fig. 6.

1 .....

2 .....

[2]

(c) When fitting a circuit board to a casing it is sometimes necessary to adjust the height of the circuit board.
Use sketches and notes to show **one** method of fitting a circuit board that will allow adjustment.

[2]

(d) Fig. 7 shows the speaker and available wires for use in an amplifier circuit.

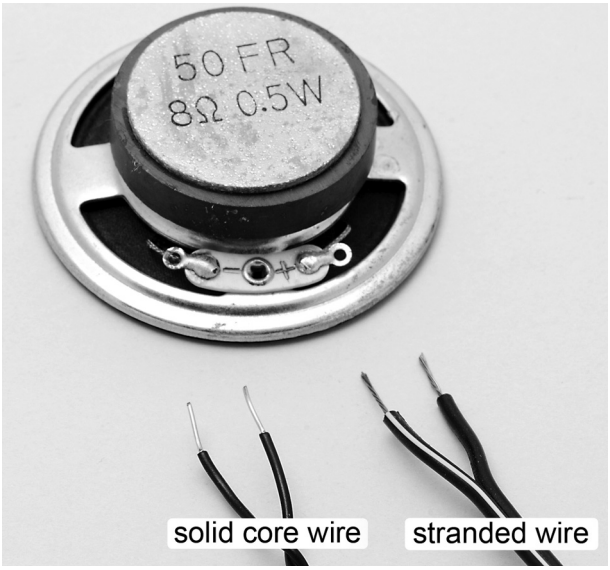


Fig. 7

(i) Give **one** reason for using the stranded wire.

..... **[1]**

(ii) Describe **two** stages in soldering the speaker wires to the connections.

1 .....

2 .....

[2]

[Total: 12]

SECTION B

Answer **all** questions.

4 A product is being developed to sense when a baby is crying. The product will switch on a motor to rotate a cot mobile for a short time.

(a) The sound sensing part of the circuit is shown in Fig. 8.

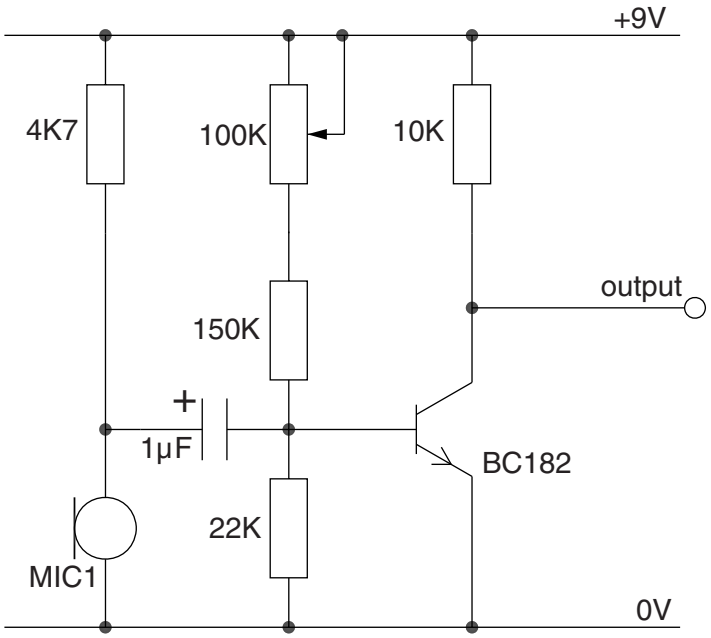
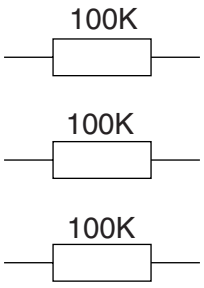


Fig. 8

(i) State the full name of the component in the circuit that will convert sound to an electrical signal.

..... **[1]**

(ii) When building a prototype circuit on a breadboard it is found that there are no 150K resistors available, the nearest value is 100K.
Add connections to the three resistors shown in Fig. 9 to give a resistance of 150K.



[2]

Fig. 9

(iii) Breadboard circuits can be constructed using CAD simulation software.
Explain why the sound sensing circuit should be tested with real components.

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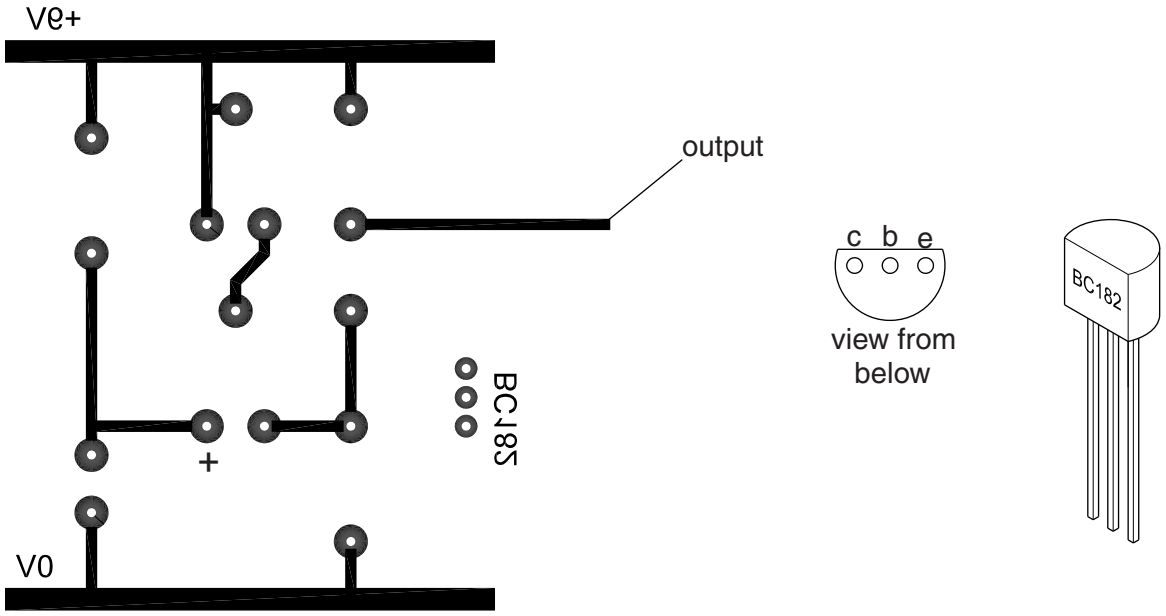
..... **[2]**

(b) Fig. 10 shows an incomplete PCB layout for the circuit viewed from the component side.
Using the information from the pinout diagram add the tracks for the BC182 transistor.



[3]

Fig. 10

(c) The table in Fig. 11 gives details of two ICs that could be used to provide a monostable pulse that will operate the cot mobile for a short time.

	inputs	outputs	supply voltage	format	memory
555 IC	1	1	3 – 15V	8 pin DIL	
PIC IC	2 – 5	1 – 4	3 – 5V	8 pin DIL	2048 bytes

Fig. 11

(i) Give **one** functional reason for choosing the 555 timer IC.

.....

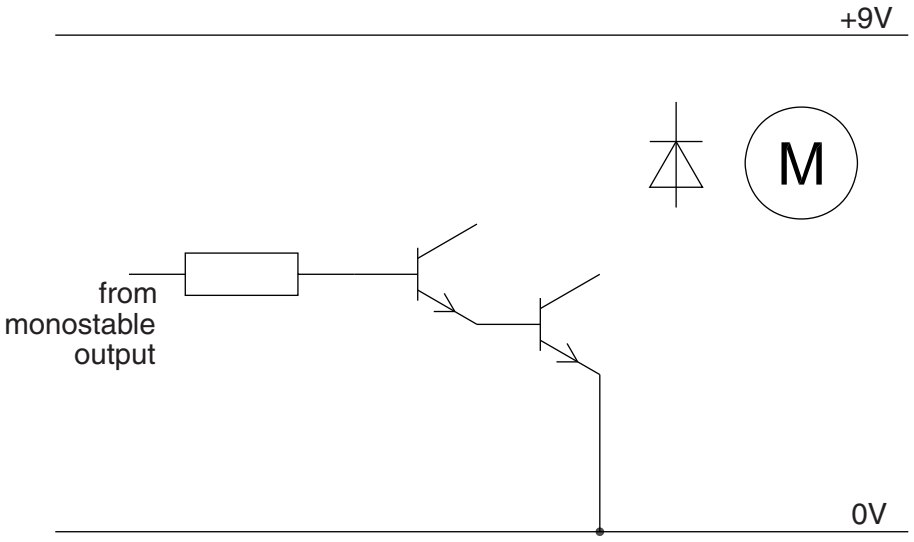
..... **[1]**

(ii) State **one** functional advantage that the PIC IC can offer.

.....

..... **[1]**

(d) The motor drive circuit for the cot mobile is shown in Fig. 12.
Add the connections to complete the circuit.



[2]

Fig. 12

[Total: 12]

5 **(a)** Part of the circuit for a digital dice is shown in Fig. 13.
The 4 bit binary output of the 4510B counter IC is decoded by the 4511B decoder IC.
A single digit common cathode green LED display shows the output.

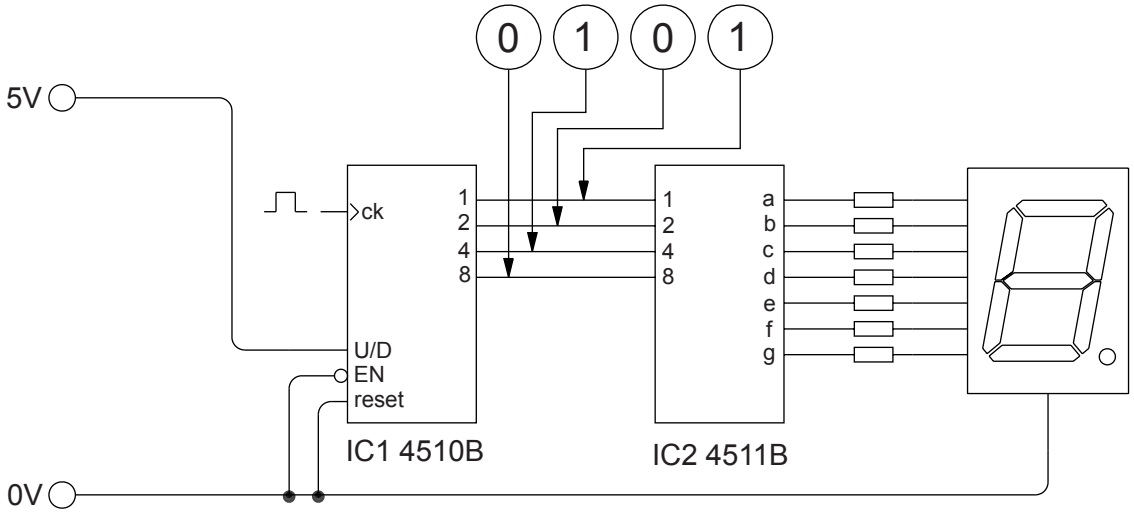


Fig. 13

(i) The binary values of the inputs to IC2 are **0101**.
Shade in the 7 segment display to show the number that will be output from IC2. **[1]**

(ii) Explain what is meant by 'common cathode' in the display description.

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..... **[2]**

(b) Fig. 14 shows a datasheet table for the single digit green LED display that will be used.

Parameter	High Efficiency Red	Green	Yellow	Superbright Red	Units
Power Dissipation	105	105	105	100	mW
DC Forward Current	30	25	30	30	mA
Peak Forward Current	160	140	140	155	mA
Reverse Voltage	5	5	5	5	V

Fig. 14

(i) Draw a circle around the DC forward current that will be used. **[1]**

(ii) Calculate the resistor value for each segment of the LED.
Use the DC forward current for the green LED display and the formula **V = I × R**.

.....

..... **[2]**

(c)* Hand-held electronic products such as mobile phones and electronic games have a range of different functions built into them.
Explain how designers can apply ergonomics to the design of hand-held electronic products.

Marks will be awarded for the quality of written communication in your answer.

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[Total: 12]

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