

OCR

Oxford Cambridge and RSA

Tuesday 23 May 2017 – Morning

GCSE DESIGN AND TECHNOLOGY: ELECTRONICS AND CONTROL SYSTEMS

A515/01 Sustainability and technical aspects of designing and making –
Electronics

Candidates answer on the Question Paper.

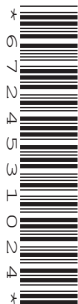
OCR supplied materials:

None

Other materials required:

- A calculator may be used for this paper.
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 30 minutes



Candidate forename		Candidate surname	
-----------------------	--	----------------------	--

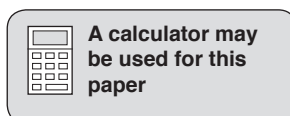
Centre number						Candidate number				
---------------	--	--	--	--	--	------------------	--	--	--	--

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 and make sure that you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.
- Show all working out for calculations.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of the question or part question.
- The total number of marks for this paper is **80**.
- Your quality of written communication is assessed in questions marked with an asterisk (*).
- Dimensions are in millimetres unless stated otherwise.
- This document consists of **20** pages. Any blank pages are indicated.



SECTION A

Answer **all** the questions.

You are advised to spend 40 minutes on this section.

On questions 1–5 **circle** your answer.

- 1 Screw-on tops are removed from plastic containers before recycling because:
- (a) They contain different chemical properties
 - (b) They are a choking hazard
 - (c) They need cleaning separately
 - (d) It is not practical to recycle them [1]
- 2 Tertiary recycling is described as:
- (a) Using a chemical process to break down an existing product to make a new one
 - (b) The second-hand use of a product without changing or altering it
 - (c) Altering the product to use it in another way without the use of chemicals
 - (d) The dismantling of a product to produce parts that can be re-used [1]
- 3 Which statement is **not** correct?
- (a) Disassembly of a product supports the recycling process
 - (b) Disassembly of products adds to the use of landfill sites
 - (c) Knock down fittings make it easier to disassemble a product
 - (d) Disassembly makes it easier to repair a product [1]
- 4 The symbol below stands for:
-
- (a) Recycling code for plastics
 - (b) Carbon footprint
 - (c) Greenhouse emission warning
 - (d) Recycling code for a specific metal [1]

- 5 Ergonomics is the study of:
- (a) The human body and its movement
 - (b) The cost of manufacturing a product
 - (c) The life cycle of a product
 - (d) Materials and their properties
- [1]

6 Give **one** reason why products should be adapted and re-used to suit an alternative use.

..... [1]

7 State the meaning of the term 'carbon offsetting'.

..... [1]

8 Fig. 1 shows two types of light bulb.

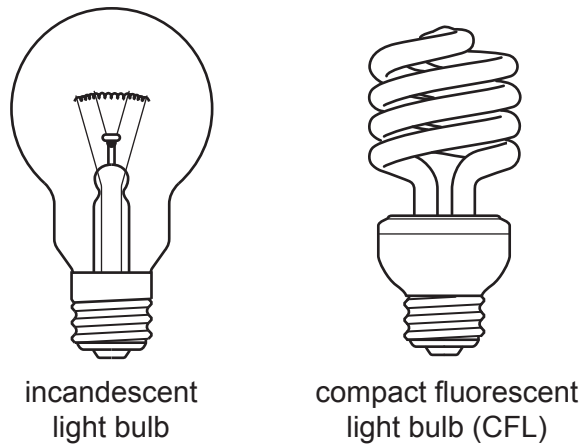


Fig. 1

Give **one** reason why a compact fluorescent light bulb (CFL) is more environmentally friendly than an incandescent light bulb.

..... [1]

- 9 The sign shown in Fig. 2 is mainly coloured red.



Fig. 2

Give **one** reason why the sign in Fig. 2 is coloured red.

..... [1]

- 10 State which of the 6Rs describes not using a material because it is harmful to the environment or people.

..... [1]

Decide whether the statements below are **true** or **false**.

Tick [✓] the box to show your answer.

	True	False	
11 ETI stands for Ethical Trading Initiative.	<input type="checkbox"/>	<input type="checkbox"/>	[1]
12 Moral issues protect the safety of users of products.	<input type="checkbox"/>	<input type="checkbox"/>	[1]
13 The British Standards Institute regulates the price of products.	<input type="checkbox"/>	<input type="checkbox"/>	[1]
14 Solar power is a finite source of energy.	<input type="checkbox"/>	<input type="checkbox"/>	[1]
15 Globalisation has decreased international trade.	<input type="checkbox"/>	<input type="checkbox"/>	[1]

16 Fig. 3 shows a retractable dog lead that can be extended to 10 m.

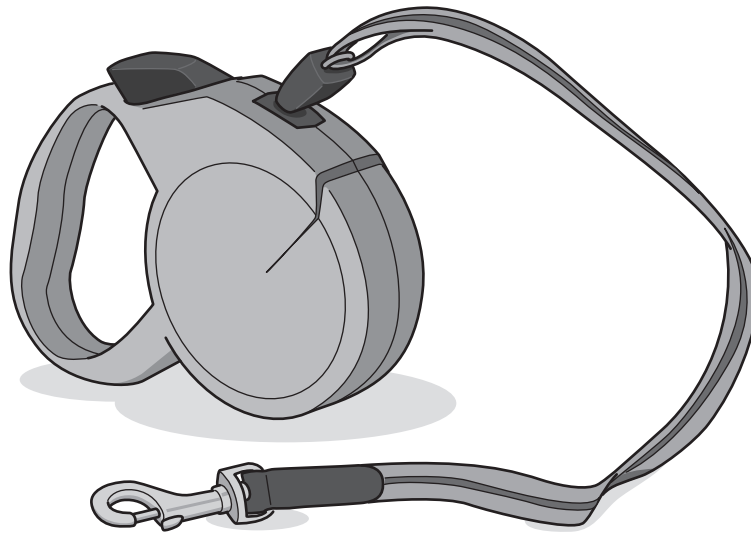


Fig. 3

(a) Identify **three** design features of the retractable dog lead in Fig. 3.

- 1.....
- 2.....
- 3.....

[3]

(b) The retractable dog lead does not require a power source to work. Give **two** benefits this has for the environment.

- 1.....
-
- 2.....
-

[2]

(c) A smart material such as phosphorescent paint can be used to coat the lead so it can be used at night.

Explain what a smart material is.

-
-

[2]

- (d) The manufacturer wishes to improve the dog lead in Fig. 3 so that it includes a night light and dog bag dispenser.

Use sketches and notes to show the improved design.
Label all materials and components used.

[5]

- (e) Corrugated card will be used as packaging for the dog lead.
Give **two** reasons why this is a suitable material for the packaging.

1.....
.....
2.....
.....

[2]

8
SECTION B

Answer **all** the questions.

You are advised to spend 50 minutes on this section.

17 Fig. 4 shows an LED and a bezel that will be used to mount the LED in an aluminium panel.

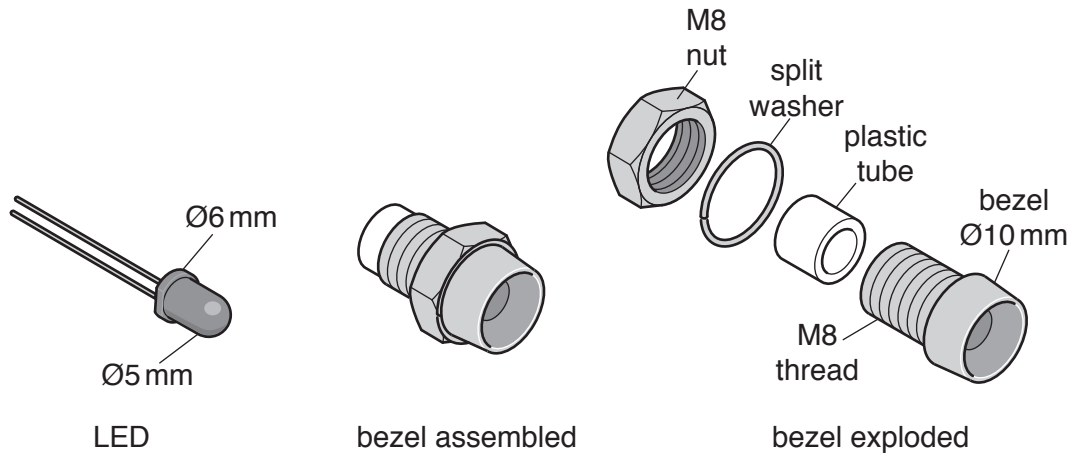


Fig. 4

(a) (i) On the list below, circle the size of drill bit that would be used for the hole in the aluminium panel.

- 5 mm 5.5 mm 6 mm 8 mm 10 mm**

[1]

(ii) Describe how the panel would be marked out and prepared for drilling.

.....

.....

.....

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

(iii) Describe **one** manufacturing precaution that should be taken when drilling the aluminium panel to ensure a high quality outcome.

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

(iv) Fig. 5 shows a cross section of the panel.
Complete Fig. 5 to show how the bezel is secured in the panel using the M8 nut and split washer.



Fig. 5

[3]

(b) (i) A row of five LEDs are to be connected to a circuit board with flying leads.
Give **two** reasons why ribbon cable could be useful in this application.

1
.....
2
..... [2]

10

(ii) Fig. 6 shows an LED.

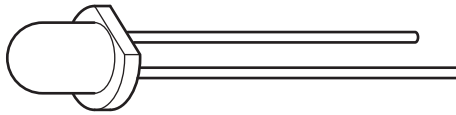


Fig. 6

Use sketches and notes to show **one** method of attaching the flying leads to the LED so that the legs cannot short circuit.

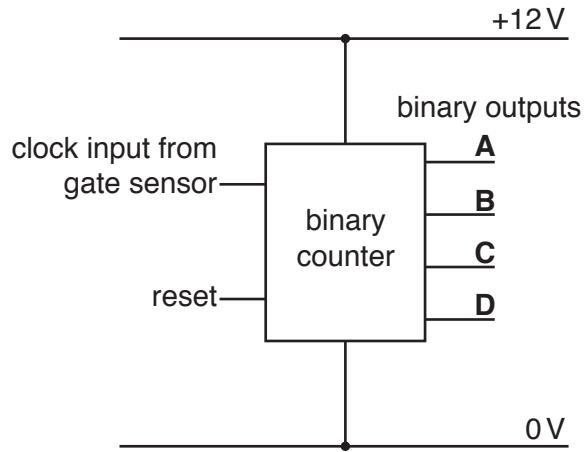
[2]

(c) Twenty identical panels are to be produced; each panel is to have five holes in a row. Use sketches and notes to describe **one** method of ensuring that the holes are in line and that each panel is identical.

[3]

18 A ride at a fun-fair can carry a maximum of six people. A binary counter will be used to provide a signal when six people have passed through the entrance gate.

(a) Fig. 7 shows the circuit of the binary counter IC and a truth table.



Count number	Binary outputs			
	D	C	B	A
Reset	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3				
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0

Fig. 7

- (i) Complete the missing line in the truth table. [1]
- (ii) Draw on Fig. 7 an AND gate connected so that its output will be high when the counter output reaches number 6. [1]

- (b) The signal is used to light a lamp.
 Fig. 8 shows a circuit of the transistor driver for the lamp.

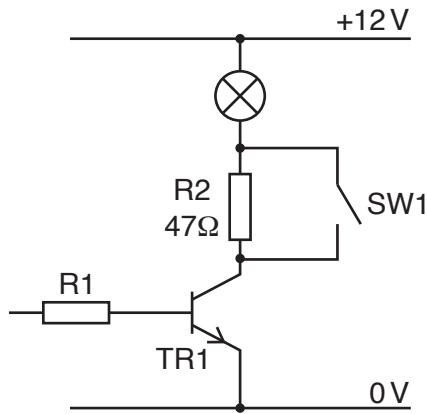


Fig. 8

- (i) The lamp has a resistance of $120\ \Omega$.
 Calculate the current through the lamp with SW1 open and TR1 switched on.

Use the formula $V = I \times R$

.....

 [3]

- (ii) State the effect on the lamp when switch SW1 is closed.

..... [1]

(iii) Computer aided design (CAD) software is being used to produce a printed circuit board layout for the transistor driver.

Fig. 9 shows the incomplete printed circuit board layout and the transistor pin diagram. Add the following tracks to the layout:

- R1 to TR1 base
- TR1 collector to R2
- Lamp to R2

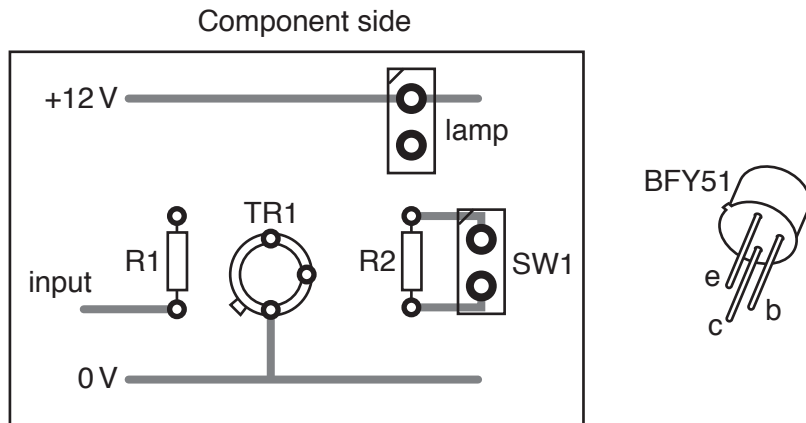
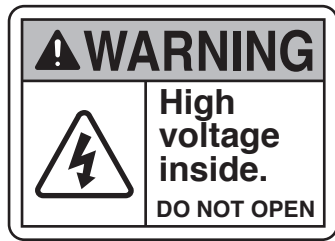


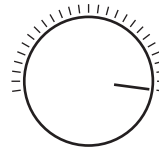
Fig. 9

[3]

- 19 (a) Labels are often used on electronic products.
Fig. 10 shows examples of a warning label and an information label.



warning label



VOLUME

information label

Fig. 10

Use sketches to show:

- **one** other example of a warning label that may be found on an electronic product

- **one** other example of an information label that may be found on an electronic product.

(b) Fig. 11 shows a box, suitable for outdoor use, containing an amplifier module and loudspeaker.

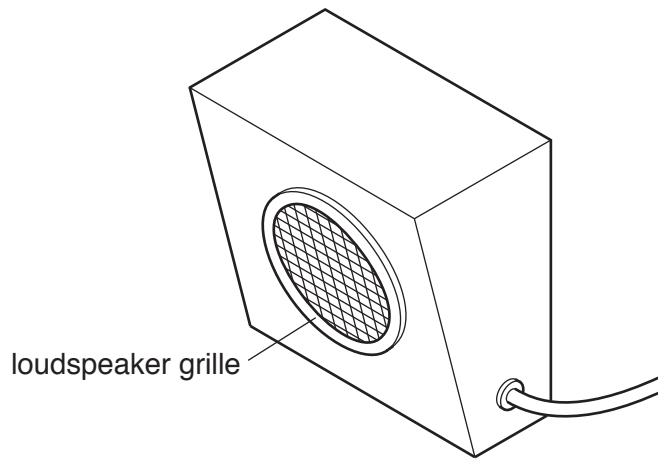


Fig. 11

Information on four amplifier modules is given in the table.

Amplifier module	Output power	Supply voltage	Stereo/Mono	Price
A	100 mW	6 V	Mono	£3.95
B	5 W	9 V	Stereo	£8.50
C	50 W	12 V	Mono	£4.75
D	8 W	30 V	Mono	£9.99

(i) State the function of the amplifier module.

.....
 [1]

(ii) Choose the most suitable amplifier module for use in the outdoor loudspeaker.

..... [1]

(iii) Give **one** reason for your choice.

.....
 [1]

(iv) The box could be made from thin sheet steel.
 State why it would be necessary to protect the steel from the outdoor environment.

.....
 [1]

(v) Give **one** method of protecting the steel.

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

(c) Vacuum formed thermoplastic could also be used to make the box for the speaker.

(i) Name a suitable thermoplastic and identify **two** properties which make it suitable for this application.

Name of thermoplastic

1

.....

2

.....

[3]

(ii) Use sketches and notes to show the shape of a suitable former for vacuum forming the box and identify **one** important feature.

[3]

(d) Smart materials can add functionality to a product.
Three examples of smart materials are:

- quantum tunnelling composite (QTC)
- shape memory alloys (SMA)
- thermochromic pigments (smart paints).

Choose **one** of the smart materials and explain how its properties can be useful in a product.

Smart material chosen.....

.....

.....

.....

.....

..... [2]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large area of lined paper for writing. It consists of a vertical solid line on the left side, creating a margin. To the right of this line, there are numerous horizontal dotted lines spaced evenly down the page, providing a guide for handwriting.

A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the 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 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.