

OCR

Oxford Cambridge and RSA

Friday 25 May 2018 – Afternoon

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 | |
|-----------------------|--|----------------------|--|

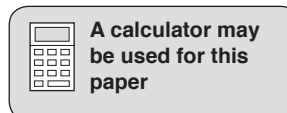
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|---------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre number | | | | | | Candidate number | | | | |
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INSTRUCTIONS TO CANDIDATES

- 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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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 **16** 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 The 6R reduce describes:
- (a) Making more products
 - (b) Making larger products
 - (c) Not using unnecessary materials or parts
 - (d) Buying a product that you never use
- [1]
- 2 Waste energy from a house can contribute to:
- (a) Global cooling
 - (b) Reducing energy bills for home owners
 - (c) Global warming
 - (d) Reducing the demand on power stations
- [1]
- 3 A product with a small eco-footprint is defined as:
- (a) Something that has a large environmental impact
 - (b) Something that has very little environmental impact
 - (c) Something that is heavy to transport
 - (d) Something lightweight and easy to move around
- [1]
- 4 A hybrid car uses:
- (a) Wind energy
 - (b) Solar power
 - (c) Fossil fuels only
 - (d) A combination of fossil fuels and electricity
- [1]
- 5 Carbon offsetting means:
- (a) Moving waste to another country
 - (b) Maximising profits from fossil fuel
 - (c) Using carbon credits to compensate for emissions
 - (d) Calculating how much natural gas is used
- [1]

- 6 Name the source of geothermal power.
..... [1]
- 7 State **one** non-sustainable method of product disposal.
..... [1]
- 8 Name the category of recycling where glass jars are cleaned and reused for the storage of components.
..... [1]
- 9 State the term used to describe products that fail after a set period of time.
..... [1]
- 10 State the term that describes how products are comfortable and easy to use.
..... [1]

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

Tick [✓] the box to show your answer.

| | True | False | |
|---|--------------------------|--------------------------|-----|
| 11 Photochromic inks change colour with varying temperatures. | <input type="checkbox"/> | <input type="checkbox"/> | [1] |
| 12 Lead paint is suitable for all electronic products. | <input type="checkbox"/> | <input type="checkbox"/> | [1] |
| 13 A biodegradable material will rot naturally. | <input type="checkbox"/> | <input type="checkbox"/> | [1] |
| 14 Deforestation can harm the environment. | <input type="checkbox"/> | <input type="checkbox"/> | [1] |
| 15 Ethical companies provide poor working conditions. | <input type="checkbox"/> | <input type="checkbox"/> | [1] |

16 Fig. 1 shows a camera with its protective case, which is suitable for adventure sports.

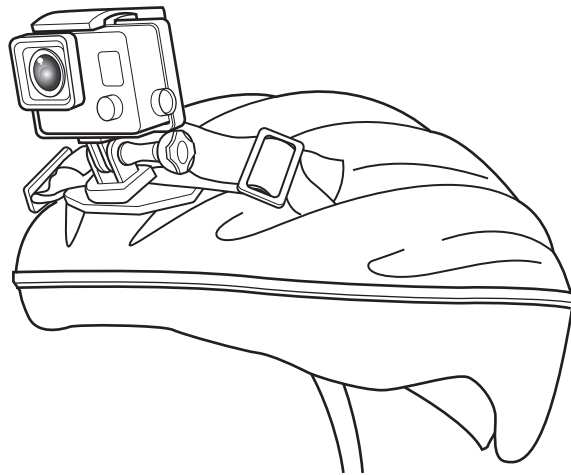


Fig. 1

(a) Give **three** design requirements for the camera casing shown in Fig. 1.

1.....

2.....

3.....

[3]

(b) The camera is powered by a rechargeable internal battery.

Give **two** environmental benefits of using rechargeable batteries to power portable products.

1.....

.....

2.....

.....

[2]

(c) Fig. 2 shows a range of fittings available for the camera shown in Fig. 1.

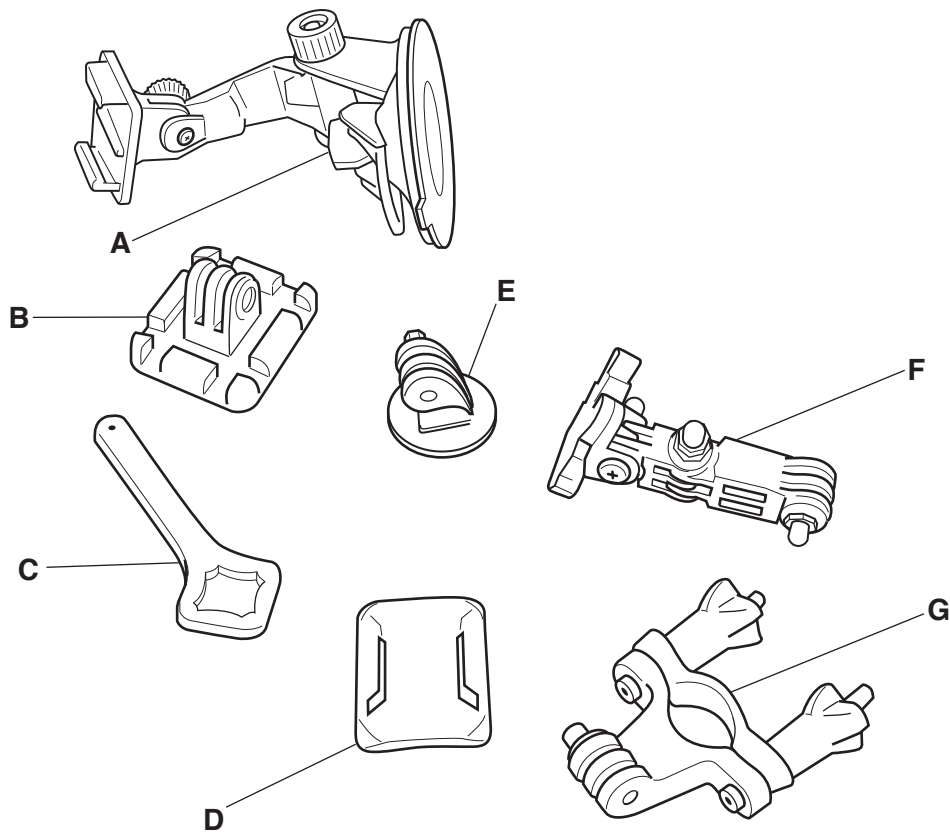


Fig. 2

Write the correct letter, **A B C D E F G**, to show which fitting would be the most suitable for mounting the camera shown in Fig. 1 in each situation given in the table below.

One has been completed for you.

| Letter | Situation |
|----------|---|
| E | Glued permanently to a flat surface |
| | On a flat piece of wood using elastic bands |
| | Internally on a car windscreen |
| | On a long round pole for use at arm's length |
| | On a flat surface but adjustable for different angles |

[4]

(d) The cameras are expensive to buy.

State **one** way of safely retaining the camera if the fitting fails during use.

.....

.....

[1]

(e) A manufacturer wishes to make a hard-shell carrying case for the camera and fittings.

Use sketches and notes to design a hard-shell carrying case for a camera and fittings.

Your design must:

- include all materials used
- show all design features.

SECTION B

Answer **all** the questions.

You are advised to spend 50 minutes on this section.

- 17 (a) Fig. 3 shows a circuit board used for computer control of LEDs and motors. The circuit board uses surface mount components.

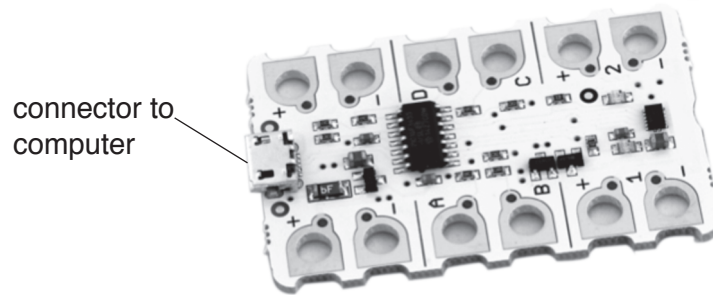


Fig. 3

- (i) State **two** benefits of surface mount components.

1

2

[2]

- (ii) Give **one** problem with using surface mount components.

.....

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

- (b) (i) A small DC motor has a coil resistance of $27\ \Omega$.
Use the formula $I = V/R$ to complete the table below.

.....

.....

.....

| | | Current |
|------------------------|---|----------------|
| Minimum voltage | 3 | |
| Maximum voltage | 9 | |

[3]

(ii) Explain why the maximum voltage and current should be considered when designing a driver circuit for the motor.

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

(c) Fig. 4 shows the motor and a piece of 3 mm acrylic sheet that it will be mounted on.



Fig. 4

In the space below use sketches and notes to show **one** method of securing the motor to the acrylic sheet.

The method used must allow the motor to be removed when necessary.

[3]

(d) Fig. 5 shows the symbols for components to be used in a driver circuit for the motor.

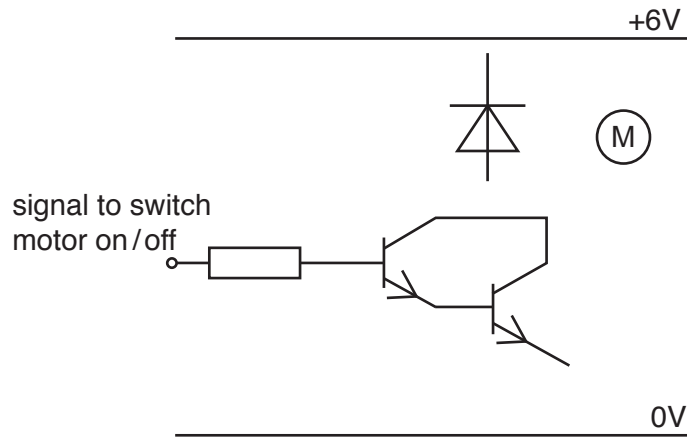


Fig. 5

(i) Complete Fig. 5 to show the connections needed for the driver circuit. [3]

(ii) The table below gives details of three transistors. Choose the most suitable transistor to be used in the driver circuit.

| Device | Type | I _c max |
|--------|---------------------------|--------------------|
| BC179 | Low power PNP transistor | 180mA |
| BC182L | Low power NPN transistor | 100mA |
| BCX38C | Darlington NPN transistor | 0.8A |

..... [1]

18 (a) Fig. 6 shows a push to make (PTM) switch that will be used to advance the count in a binary counter circuit.



Fig. 6

(i) Describe what happens when a PTM switch is operated.

.....

 [2]

- (ii) When tested on a breadboard the count is found to 'jump', missing some numbers out. State the most likely reason for this.

.....
 [1]

Fig. 7 shows the bistable circuit used to overcome the problem.

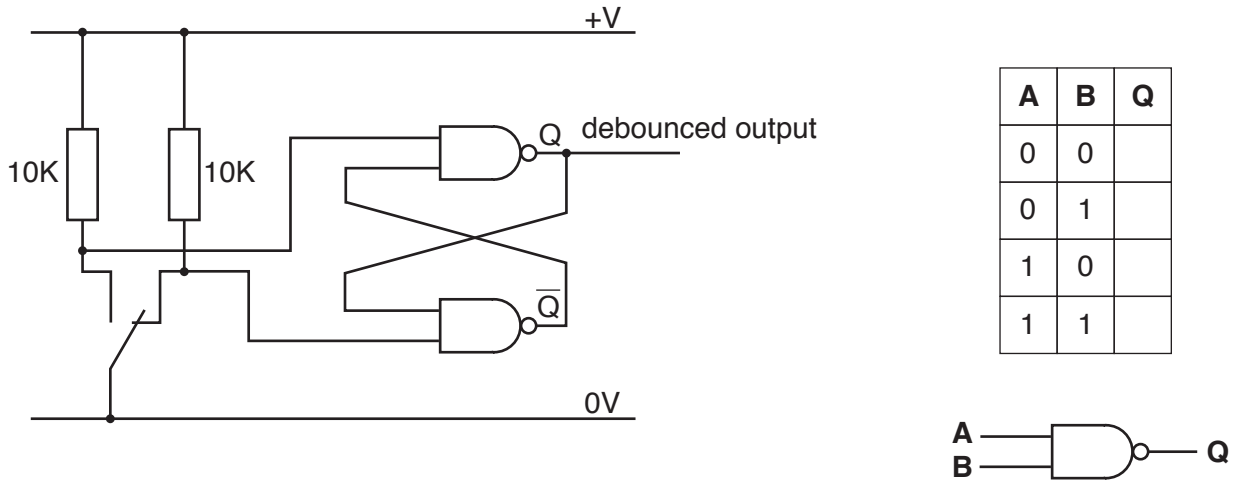


Fig. 7

- (iii) State the type of logic gate used in the circuit.

..... [1]

- (iv) Complete the truth table in Fig. 7 for the type of logic gate used.

[1]

- (v) Describe the action of a bistable circuit.

.....

 [2]

- (vi) State the purpose of the 10K resistors used in the circuit in Fig. 7.

..... [1]

- (b) Fig. 8 shows the outlines of three rows of LEDs used to represent numbers in binary. The first row represents the number 8.

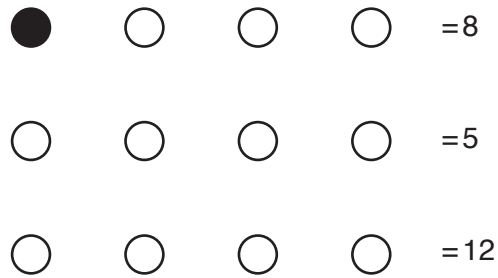


Fig. 8

- (i) Shade in the LED outlines in Fig. 8 to show how the other two numbers are represented in binary. [2]
- (ii) Fig. 9 shows part of a PCB for the bistable circuit in Fig. 7 with two faults identified.

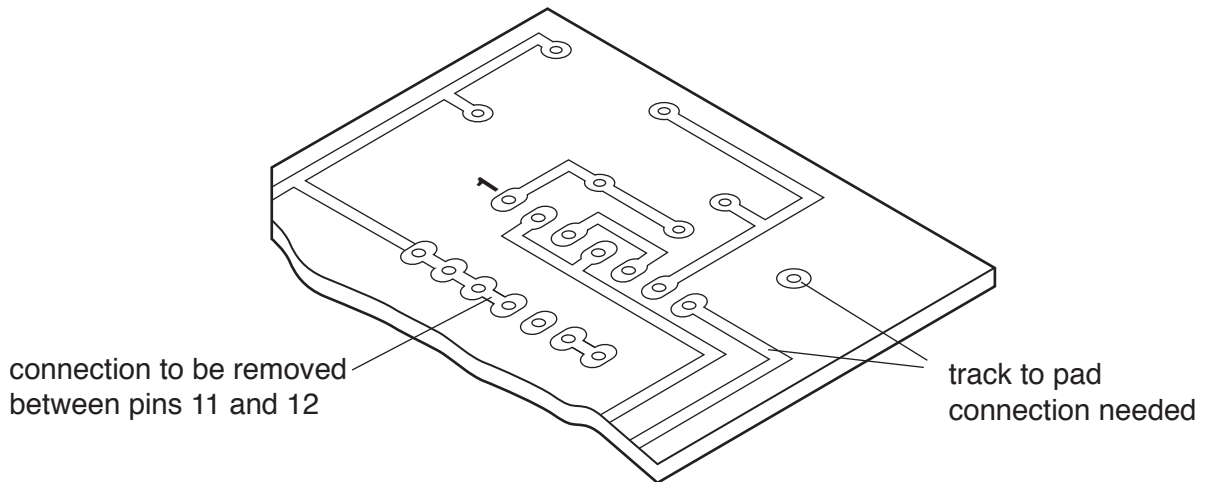


Fig. 9

In the space below use sketches and notes to describe how the faults can be repaired to make the board usable.

- (c) Counter circuits will sometimes have the display on a separate PCB with connections made using a ribbon cable.

Fig. 10 shows a ribbon cable connector before the two parts have been compressed to allow the blades to cut through the cable insulation. The pins can then be soldered into a PCB.

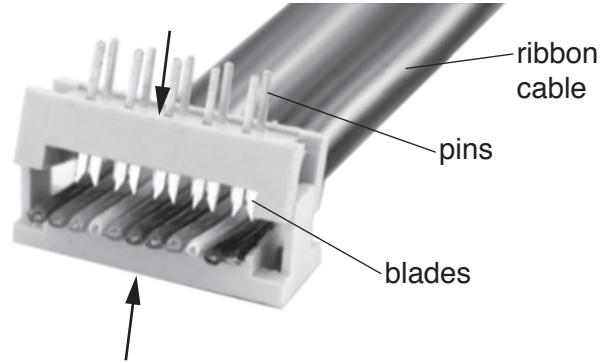


Fig. 10

Give **two** benefits of using a ribbon cable connector.

1.....

 2.....

[2]

- 19 (a) Fig. 11 shows four power sources that can be used for electronic projects.

Circle the **two** power sources in Fig. 11 that can have their charge replaced.

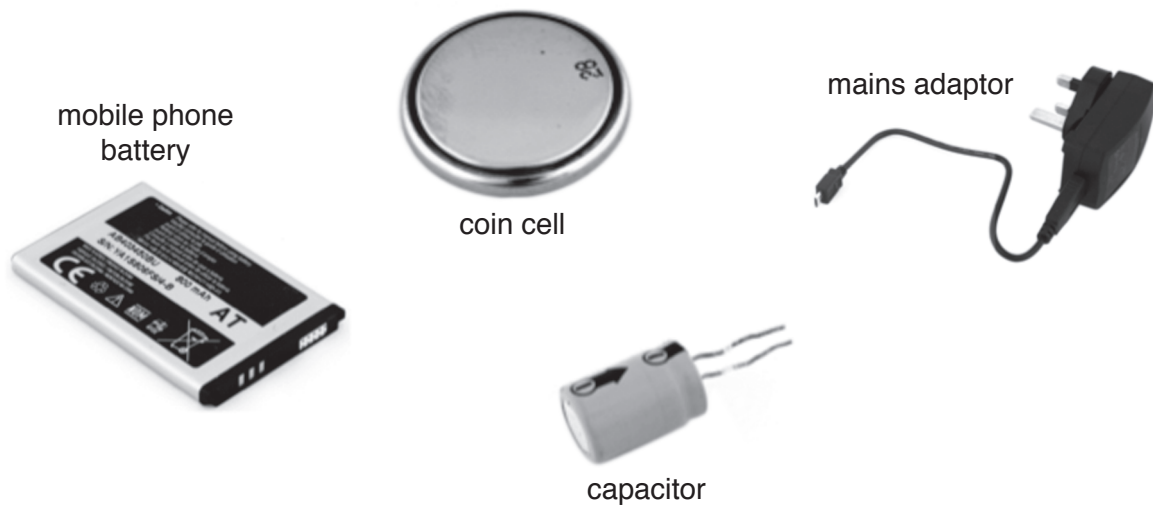


Fig. 11

[2]

Turn over

- (b) (i) Complete the circuit diagram in Fig. 12 to show three LEDs connected in parallel to the power supply.

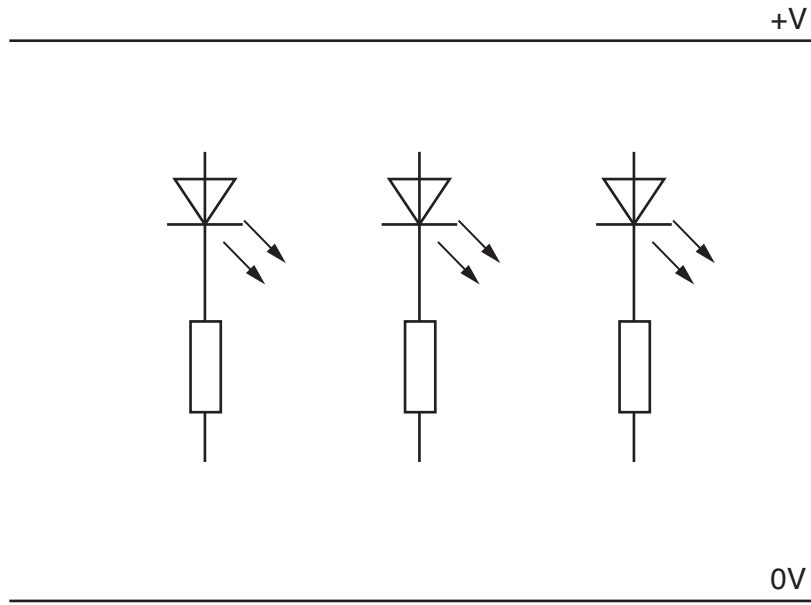


Fig. 12

[3]

- (ii) Give **one** reason for using a parallel connection for the LEDs.

.....
 [1]

- (c) Sensors can be used to decide when a circuit will operate.
 State the name of a sensor that can detect changes in the following conditions:

Heat

Light

Sound

[3]

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