

Surname	Centre Number	Candidate Number
Other Names		2



**GCE A LEVEL – NEW**

1601U30-1



**DESIGN AND TECHNOLOGY – A2 unit 3**  
**Engineering Design**

FRIDAY, 7 JUNE 2019 – MORNING

2 hours 30 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	8	
2.	8	
3.	12	
4.	12	
5.	8	
6.	8	
7.	12	
8.	12	
9.	8	
10.	12	
<b>Total</b>	<b>100</b>	

**ADDITIONAL MATERIALS**

A calculator, ruler, pencil and coloured pencils.

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen.

Answer **ALL** questions.

Write your name, centre number and candidate number in the spaces at the top of this page.

Write your answers in the spaces provided in this booklet. If you run out of space, use the continuation page(s) at the back of the booklet, taking care to number the question(s) correctly.

**INFORMATION FOR CANDIDATES**

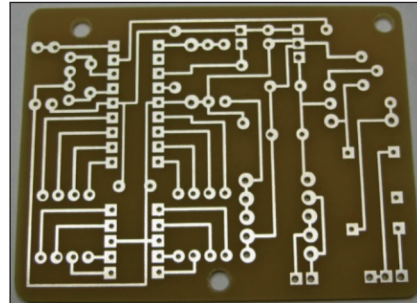
The number of marks is given in brackets at the end of each question or part-question. You are advised to divide your time accordingly.

The total number of marks available is 100.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question **10**.

Answer all questions.

- 1. A PCB drill is used to prepare a printed circuit board for construction in a school workshop.



- (a) Describe **three** health and safety considerations when using the PCB drill. 3 x [1]

Consideration 1: .....

.....

Consideration 2: .....

.....

Consideration 3: .....

.....

- (b) The student needs to reduce the size of the PCB by removing excess material around the edges.

Produce a five step risk assessment for the student when using the disc sander shown to reduce the size of the PCB. 5 x [1]

Step 1: .....

.....

Step 2: .....

.....

Step 3: .....

.....

Step 4: .....

.....

Step 5: .....

.....



2. The fire extinguisher pictured below shows information including the BSi mark.



(i) Explain the meaning of the BSi mark featured on this product. [2]

.....

.....

.....

(ii) Explain how the manufacturer of this product achieves the BSi mark. [2]

.....

.....

.....

(iii) Explain **two** benefits to the consumer of purchasing the fire extinguisher with the BSi mark as shown. 2 x [2]

Benefit 1: .....

.....

.....

Benefit 2: .....

.....

.....

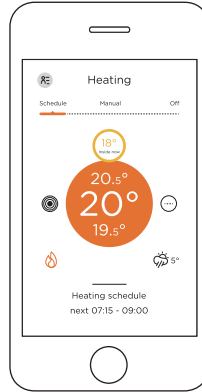
1601U301  
03

3. A household central heating controller has been designed to allow full control of hot water and heating by occupants setting the 7 day programming feature or using an 'App' with a smart phone, laptop or computer.

Household controller



App feature



Features:

- Geolocation
- App Controllable
- 7 Day Programmable
- Holiday Mode
- Heating & Hot Water Boost
- Frost Protection Setting
- LED Digital Display
- Wall-Hung and portable
- Powered by 3v (2 x AA batteries included)

- (a) The household controller is intended to be stylish and minimalistic. Explain how this has been achieved. [2]

.....

.....

.....

- (b) Before producing design ideas, a research team was assembled to investigate the anthropometric data of the target market.

Describe the type of information that this research would provide and explain how this information would be of value to the designer. [3]

.....

.....

.....

.....

.....

- (c) Describe **two** advantages to the designer of using Computer Aided Design (CAD) during the development of the device. 2 x [2]

Advantage 1: .....

.....

.....

Advantage 2: .....

.....

.....

- (d) Explain the impact that modern materials and technology has had on the development of the electronic device. [3]

.....

.....

.....

.....

.....

.....

4. A new pre-production proposal for a cordless rechargeable screwdriver below has been designed to revitalise an older existing product.



New cordless screwdriver



Existing cordless screwdriver

- (a) Describe the most suitable scale of production for the new cordless screwdriver. [3]

.....

.....

.....

.....

.....

- (b) The new cordless screwdriver has been designed to have a built in rechargeable battery.

- (i) Explain how the new screwdriver could be considered more sustainable than the existing cordless screwdriver. [2]

.....

.....

.....

- (ii) Describe **one** disadvantage of having a built in battery. [2]

.....

.....

.....

- (c) The new cordless screwdriver is supplied with a mains adapter to charge the battery. This adapter is manufactured overseas and bought-in as a standard component.



Describe the impact on the manufacturer of adopting this approach when producing the new cordless screwdriver in high volume. [2]

.....

.....

.....

- (d) When releasing the new cordless screwdriver into the market, the manufacturer must consider product support and customer services. Explain the impact product support and customer services will have on the success of the product in the marketplace. [3]

.....

.....

.....

.....

.....

.....

5. The sliding electric gate shown below is operated by an infra-red remote control handset. Users press a button on a handset to activate open, close or pause the sliding gate. Two sensors detect when the gate is fully open or fully closed.

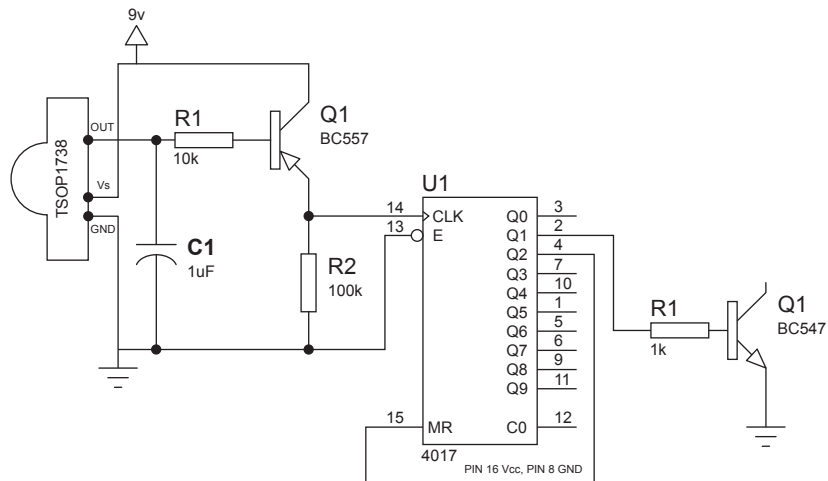


Sliding electric gates



Remote control handset

Study the electronic circuit diagram below which controls the sliding gates.



- (i) Describe how the input to this system functions. [2]

.....

.....

.....

- (ii) Explain the reason for the component labelled **C1**. [2]

.....

.....

.....

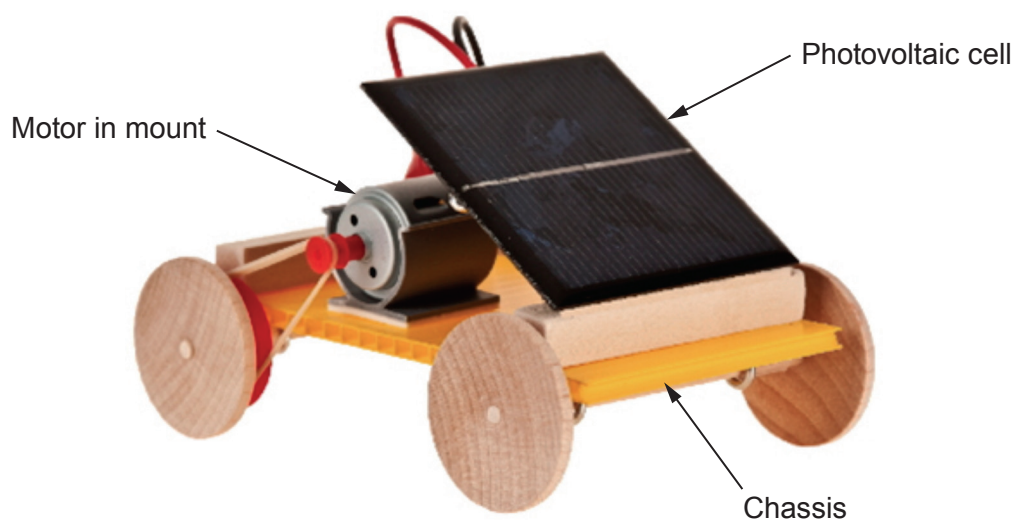


- (iii) Explain, using notes and sketches, how you would add a relay switch with a 240 volt power supply and motor to the circuit above to operate the sliding electric gate. [4]

Examiner  
only

1601U301  
09

6. The toy car shown below has been designed and made in a school workshop.



(i) Describe the properties of a named polymer that make it suitable for the chassis of the toy car. [2]

Named polymer: .....

Properties: .....

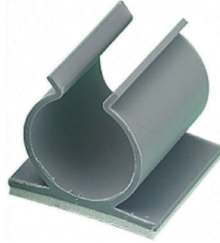
.....  
.....

(ii) Explain in detail how the photovoltaic cell powers the toy car. [3]

.....  
.....  
.....  
.....  
.....

- (iii) Explain how the process of injection moulding is used to manufacture the ABS motor mount shown. [3]

Examiner  
only



.....

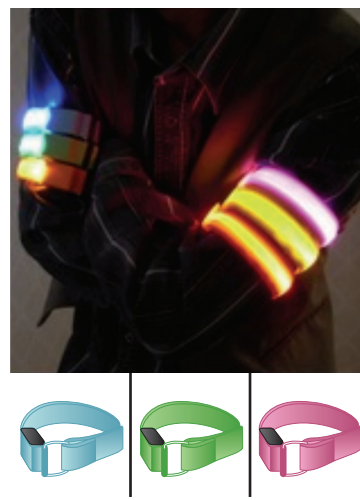
.....

.....

.....

.....

7. A range of illuminating armbands have been designed to allow users to become more visible when exercising outdoors in dark conditions.



- (a) A block diagram approach is often used when designing control systems.
- (i) In the space below complete a block diagram for the control system of the illuminating armband. [3]

- (ii) Explain how this block diagram will support the designer to develop the control system for the arm band. [2]

.....

.....

.....

.....

(b) Study the design of the children’s play frame shown below.



(i) Identify **two** different parts of the children’s play frame that experiences a bending force. 2 x [1]

Part 1: .....

Part 2: .....

(ii) Explain the reason for including **Part B** in the children’s play frame. [3]

.....

.....

.....

.....

.....

(iii) The designer wishes to extend the swing beam so that three swings replace the two swings shown above. Describe how the designer could do this, justifying any modifications. [2]

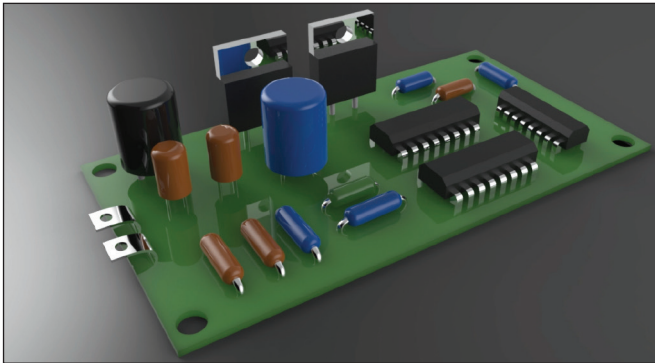
.....

.....

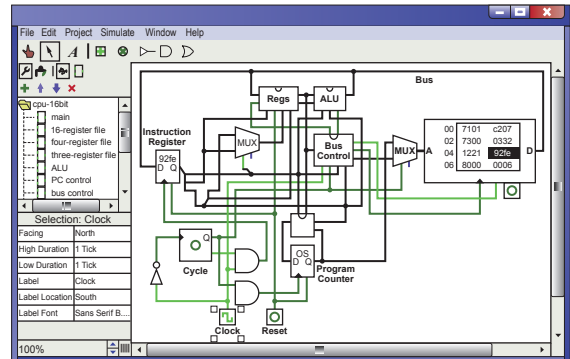
.....

.....

8. The images below show electronic control systems being modelled using ICT.



Example A



Example B

- (a) (i) Describe why modelling an electronic control system, as shown in Example B, is important prior to full scale manufacture. [2]

.....

.....

.....

- (ii) Explain how the model in Example A is critical when calculating material and components costs for commercial manufacture. [2]

.....

.....

.....

(b) A commercial manufacturer configures a semi-automated production line to mass produce printed circuit boards.

(i) Describe how the use of a semi-automated production line will impact on productivity. [4]

.....

.....

.....

.....

.....

.....

(ii) Explain how using JIT manufacture to produce the printed circuit boards will benefit both the manufacturer and the end user. [4]

.....

.....

.....

.....

.....

.....

9. The original 1959 Mini shown below is considered a design classic.



(a) Analyse how the features of a product contribute to making a design classic. [4]

.....

.....

.....

.....

.....

.....

.....

.....



(b) The images below show how a revitalised model of a telephone improves an existing product yet retain some signature styling details.

Analyse how historical influences can be seen in the developments of the products shown below. [4]



1930s Telephone



1980s Telephone



Modern Telephone

.....

.....

.....

.....

.....

.....

.....

.....

10. The outdoor decking area shown has been constructed using a wood polymer composite material.

Features:

- The composite is guaranteed for 25 years after installation.
- The composite is 55% hardwood beech fibres sources from sawmills, and 45% HDPE (high density polyethylene) from used milk bottles.
- The manufacturer of the composite claims that the material is 'carbon negative'.



Evaluate the environmental factors of using this composite material.

[12]

*Marks will be awarded for the content and the quality of written communication.*

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



**For continuation only.**

A series of horizontal dotted lines spanning the width of the page, providing space for continuation of an answer.