Surname	Centre Number	Candidate Number
First name(s)		2

GCE AS/A LEVEL

2601U10-1

S23-2601U10-1

MONDAY, 15 MAY 2023 – AFTERNOON

DESIGN AND TECHNOLOGY – AS unit 1
Engineering Design

2 hours

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**8**	
3.	**8**	
4.	**8**	
5.	**8**	
6.	**40**	
Total	**80**	

2601U101
01

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.

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 80.

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 **3**.

Examiner only

1. The Printed Circuit Board shown in figure (i) has been developed as a prototype. The board shown in figure (ii) is a commercial product that has been made by batch production.

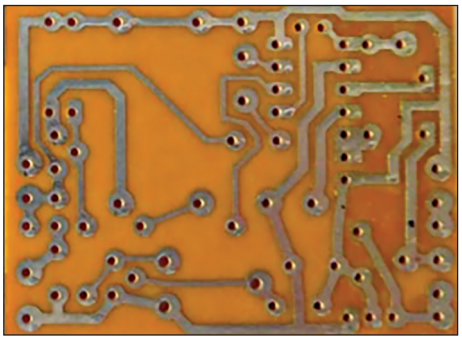

Figure (i) Prototype

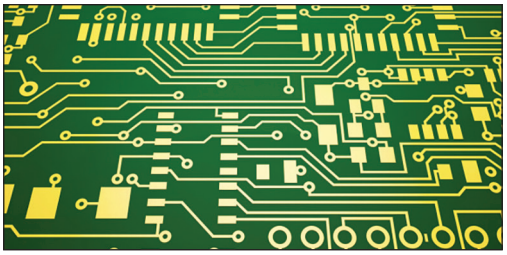

Figure (ii) Batch Produced

(a) Describe a feature of the circuit in Figure (ii) that would enable components to be easily added by batch production at reduced cost. [2]

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(b) Ferric Chloride and Sodium Hydroxide are two potentially dangerous chemicals that are often used in the production of printed circuit boards.

Complete the Five Step Risk Assessment below, justifying **each** of the steps needed when working with potentially dangerous chemicals. [4]

Step 1 has been completed for you.

Step 1:

Identify the hazard. The chemical being used is corrosive and could damage the skin and/or eyes.

Step 2:

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Step 3:

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Examiner only

Step 4:

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Step 5:

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(c) Describe how a CNC machine could be used to produce a Printed Circuit Board (PCB). [2]

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Examiner only

2. Acrylonitrile Butadiene Styrene (ABS) is a material that will be used for the design of the casing that will enclose an electronic product as shown below.

(a) (i) State **three** reasons why ABS would be a suitable material for the casing. 3 × [1]

Reason 1: .....

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Reason 2: .....

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Reason 3: .....

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(ii) The casing is made by injection moulding. Explain why injection moulding is an appropriate process to use in the manufacturing of the casing. [3]

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(b) Describe the ways in which the designer and manufacturer can reduce the environmental impact of using plastic materials in commercially produced products. [2]

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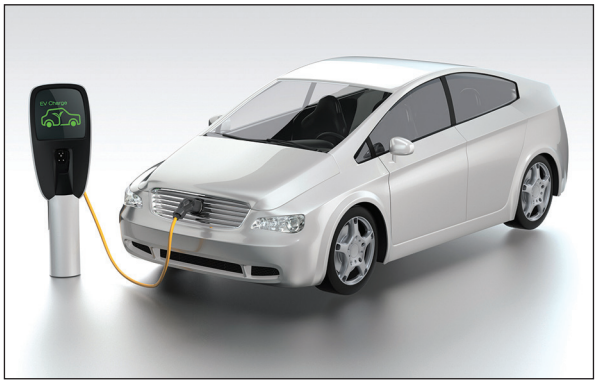
Examiner only

3. Designers have developed products in response to both market pull and technology push, such as the electric car shown below.

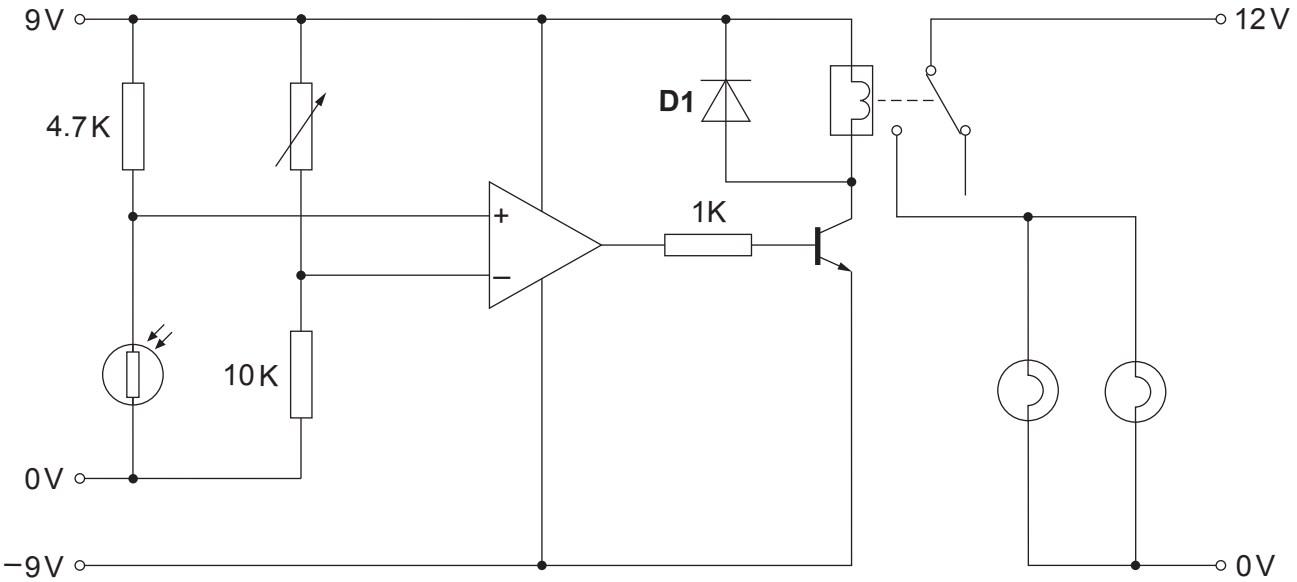


Analyse how market pull and technology push have influenced the design and development of an electric car. [8]

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

4. The circuit diagram shows how an operational amplifier is used to automatically turn on the garden lights when the light level drops below a predetermined level.

Garden Lights



Examiner only

(a) (i) Describe in detail how the operational amplifier controls the garden lights. [4]

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(ii) Describe the purpose of the component labelled **D1** on the circuit diagram. [2]

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(iii) The filament bulbs shown in the circuit diagram are increasingly being replaced by LEDs. Explain why this is the case. [2]

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Examiner only

5. (a) The images below show a traditional static baby bouncer and a more modern electronic version that can be operated using outputs from a mobile phone to create oscillating and reciprocating motion.

Traditional static baby bouncer

Modern electronic baby bouncer

(i) The electronic baby bouncer moves with both oscillating and reciprocating motion. Explain the term oscillating motion. [2]

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(ii) Describe **one** force that the designer has had to consider when designing the traditional static baby bouncer. [2]

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Examiner only

(b) Use the space below to draw a cam or crank mechanism that could be used to convert rotary to reciprocating motion in the modern electronic baby bouncer. [4]

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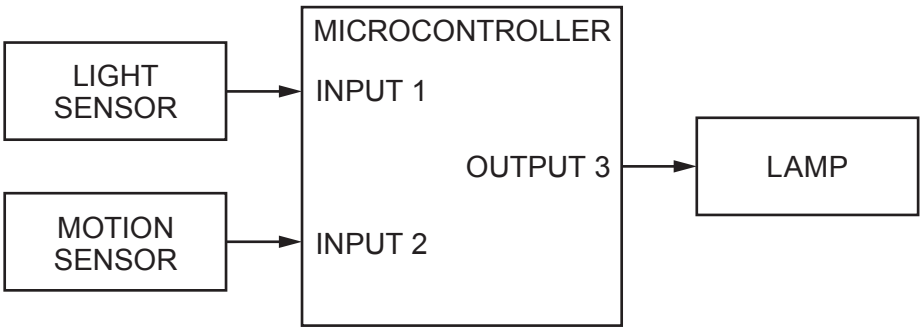
Examiner only

6. The images show a vertical axis wind-powered generator that has been developed to provide energy for bus stop shelters in remote locations.

(a) Evaluate the advantages to potential customers of having an electrical power source in a modern bus shelter. [8]

Examiner only

(b) The bus shelter needs an energy-saving lamp that will turn on only when it is dark and when the shelter is being used by potential passengers. The block diagram below shows how a microprocessor is used to control the system.



(i) In the space provided design a flow chart that will enable the microprocessor to be programmed in order to control the lamp. [8]

Your design must:

- use a microprocessor to activate the lamp automatically when approached by a passenger
- only operate in low light conditions
- switch off the lamp after a time delay of 20 seconds when there is no movement detected in the bus shelter.

Examiner only

Draw your flowchart below

Examiner only

(ii) Design a suitable housing for the lamp that can be attached to the bus shelter

Your design must:

- hold three 25mm diameter LEDs
- be housed securely to prevent possible vandalism
- open easily when required for maintenance
- be securely attached to the bus shelter.

Marks will be awarded for:

- sketching your initial ideas [4]
- a well-developed final solution [6]
- detailed notes that explain your thinking [4]
- proposals for the appropriate use of materials and critical dimensions. [2]

Sketch your initial ideas here

Examiner only

Draw your final design for the housing below

Examiner only

(c) Explain **two** detailed reasons why wind power technology is increasingly used in new products such as the bus shelter. 2 × [2]

Reason 1:

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Reason 2:

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(d) Outline the disadvantages of using a wind-powered generator as a means of providing energy for the bus shelter. [4]

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END OF PAPER