

Design & Technology

Edexcel GCSE

Programmable Components

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- For the multiple choice questions, circle your answer

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don't spend too much time on one question

Good luck!

Q1. Which flowchart symbol is used for a decision?

- A** Rectangle
- B** Diamond
- C** Rounded box

Q2. Which of the following is a digital input?

- A** A push switch
- B** A thermistor
- C** A light dependent resistor

Q3. What does a delay command do in a program?

- A** Repeats part of the program
- B** Counts how many times a button is pressed
- C** Pauses the program for a set time

Q4. What is contained on a single microcontroller chip?

- A** A processor, memory and input/output pins
- B** A battery and a motor
- C** A speaker and a microphone

Q5. An analogue signal

- A** can only be on or off
- B** can be any value within a range
- C** can only be used for outputs

Q6. Which flowchart symbol is used for the start and end of a program?

- A** Diamond
- B** Parallelogram
- C** Rounded box

Q7. A jewellery box uses a programmable component to turn on a musical tune when the lid is opened. The tune stays on until the lid is closed.

A partly completed flowchart contains these boxes, from top to bottom: START (rounded box); MUSICAL TUNE OFF (rectangle); IS THE LID OPEN? (diamond); MUSICAL TUNE ON (rectangle).

Draw the flowchart. Correctly label the decision outputs and add the lines and arrows to show how the programmable component turns on the tune when the lid is opened, and turns it off when the lid is closed. **(3 marks)**

Q8. Give two reasons why programmable microcontrollers are used in electronic products. **(2 marks)**

1

2

Q9. Most modern electronic devices, such as smart speakers, use programmable microcontrollers.

Explain what a microcontroller does. **(2 marks)**

Q10. A microcontroller is a key component of electric bicycles.

Define the meaning of the term microcontroller and explain how they can be used in electric bicycles. **(5 marks)**

[illegible]

Answers

Q1. B

Q2. A

Q3. C

Q4. A

Q5. B

Q6. C

Q7.

A flowchart that includes feedback loops and labels to the decision box (3 marks):

- "Yes" and "No" correctly labelled on the decision box (1)
- A feedback loop with a directional arrow from "No" back to above/to the MUSICAL TUNE OFF box (1)
- A feedback loop from below MUSICAL TUNE ON back to just above the diamond decision box (1)

Q8.

1 mark for each correct reason, up to a maximum of 2 marks:

- One programmable microcontroller can replace several separate integrated circuits (chips)
- Reduced size of circuit boards
- Improved reliability
- Economies of scale: one microcontroller can be bought in bulk and programmed differently for different applications
- Bulk buying of a standard component can reduce component costs
- Allows programming upgrades, extending product life

Q9.

One mark for what a microcontroller does and one mark for explaining it (examples of products accepted), e.g.:

- Microcontrollers take information from sensors and other inputs (1), then process this information to control outputs such as speakers, lights or movement (1)

- They carry out specific tasks/functions (1), e.g. in a kettle a microcontroller switches on the heating element until it senses the water has reached boiling point (1)

Q10.

1 mark for a simple definition of a microcontroller, e.g.: it can be programmed to perform different processing functions; it is a single-board computer manufactured as an integrated circuit; it can store information; it is a control device which incorporates a microprocessor; it includes a processor, memory and input/output peripherals on a single chip.

Up to 4 marks for explaining how microcontrollers can be used in electric bicycles. For example: microcontrollers can be programmed with sensors that identify how much battery life remains (1), giving the cyclist information on how much further they can travel without running out of battery (1). A microcontroller can display the time (1), a safer option as it is in clear sight (1). Microcontrollers can also:

- Drive/power the bike's motor; control the throttle and acceleration; control the amount of pedal assist
- Control brake lights, headlights and directional lighting
- Display information via LEDs/LCDs, e.g. battery life; give warning messages/error signs
- Measure temperatures, speed and distance travelled
- Detect obstacles; act as anti-theft sensors

Credit any other appropriate response.