Write your name here

Surname		Other names

**Pearson
Edexcel GCSE**

Centre Number

Candidate Number

Design and Technology Electronic Products
Unit 2: Knowledge and Understanding of Electronic Products

Tuesday 23 May 2017 – Morning
Time: 1 hour 30 minutes

Paper Reference
5EP02/01

You may wish to use a calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches it must be dark (HB or B). Coloured pens, pencils and highlighter pens must **not** be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Pearson

Answer ALL the questions.

In each question 1 to 10, choose an answer A, B, C, or D. Put a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1   Which type of switch is shown below?
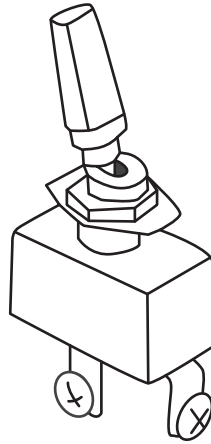
- ☒ **A** slide switch
- ☒ **B** toggle switch
- ☒ **C** micro switch
- ☒ **D** tilt switch

(Total for Question 1 = 1 mark)

2   Pine is a:

- ☒ **A** manufactured board
- ☒ **B** natural timber
- ☒ **C** composite
- ☒ **D** alloy

(Total for Question 2 = 1 mark)

3   Which law gives the formula V = I x R ?

- ☒ **A** Watt's law
- ☒ **B** Faraday's law
- ☒ **C** Galvani's law
- ☒ **D** Ohm's law

(Total for Question 3 = 1 mark)

4 The leg labelled with an X is called the:
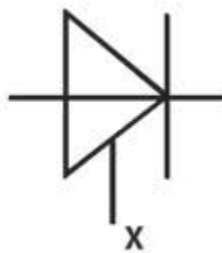
- ☒ **A** gate
- ☒ **B** collector
- ☒ **C** anode
- ☒ **D** cathode

(Total for Question 4 = 1 mark)

5 Photovoltaic cells generate electricity by using:

- ☒ **A** wind power
- ☒ **B** solar power
- ☒ **C** hydro power
- ☒ **D** bio fuels

(Total for Question 5 = 1 mark)

6 Which type of logic gate produces the outputs in the truth table below?

Input A	Input B	Output Q
0	0	0
0	1	1
1	0	1
1	1	0

☒ **A** XOR

☒ **B** OR

☒ **C** NAND

☒ **D** NOR

(Total for Question 6 = 1 mark)

7 What is the output voltage of a PP3 battery?

☒ **A** 3v

☒ **B** 6v

☒ **C** 9v

☒ **D** 1.5v

(Total for Question 7 = 1 mark)

8   What system do the images below represent?

£28.00
PAY
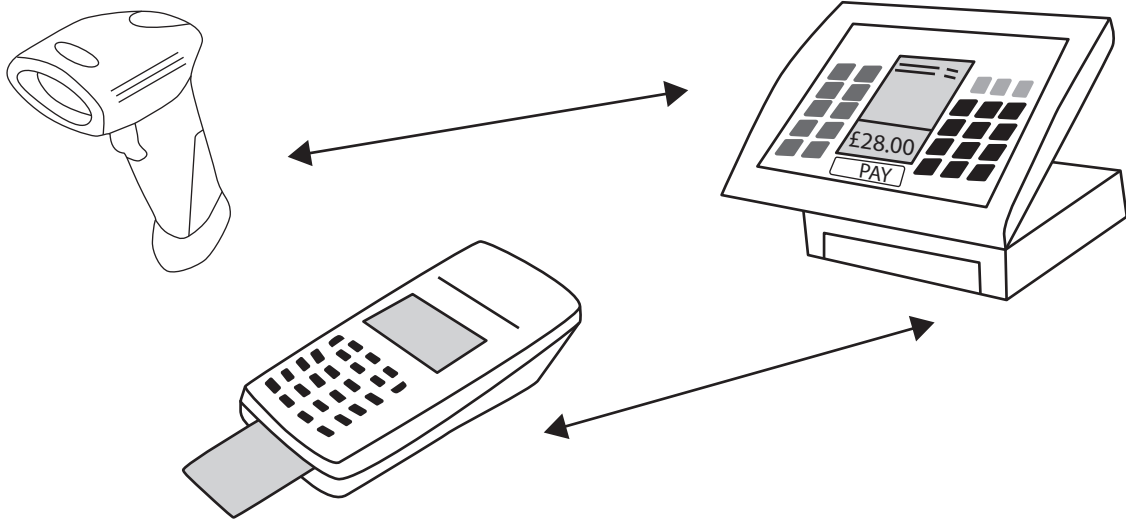
☒   **A**   CIM System

☒   **B**   FMS System

☒   **C**   EPOS System

☒   **D**   PICO System

(Total for Question 8 = 1 mark)

9   Which of the following best describes the function of the component below:

−
+
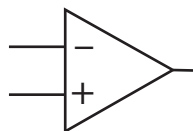
☒   **A**   amplifying current

☒   **B**   amplifying light

☒   **C**   amplifying voltage

☒   **D**   amplifying resistance

(Total for Question 9 = 1 mark)

10 Which of the following best describes the function of a biosensor?

    ☒   **A**   conversion of a biomimic response into an electrical signal

    ☒   **B**   conversion of a biometrical response into an electrical signal

    ☒   **C**   conversion of a biological response into an electrical signal

    ☒   **D**   conversion of a bionic response into an electrical signal

(Total for Question 10 = 1 mark)
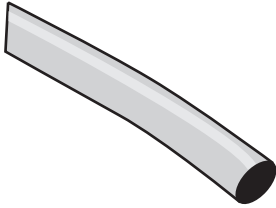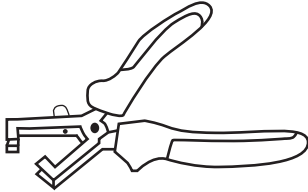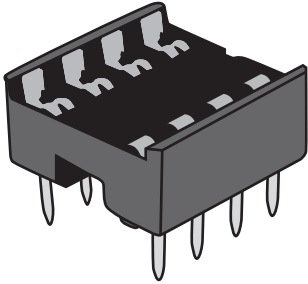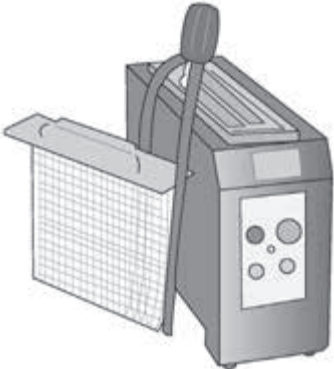
11 (a) The table below shows some tools and components.

Complete the table below by giving the missing names and uses.

(4)

Tools/Components	Name	Use
	Heat shrink tubing	
		Used to remove insulation from wire
	IC (DIL) socket	
		Equipment used to chemically remove copper and produce printed circuit boards (PCBs)

(b) The circuit diagram shows a prototype personal alarm which can be triggered by one or more switches. It is controlled by a PIC (peripheral interface controller).

Pin 3 and Pin 4 are inputs. Pin 7 is an output.
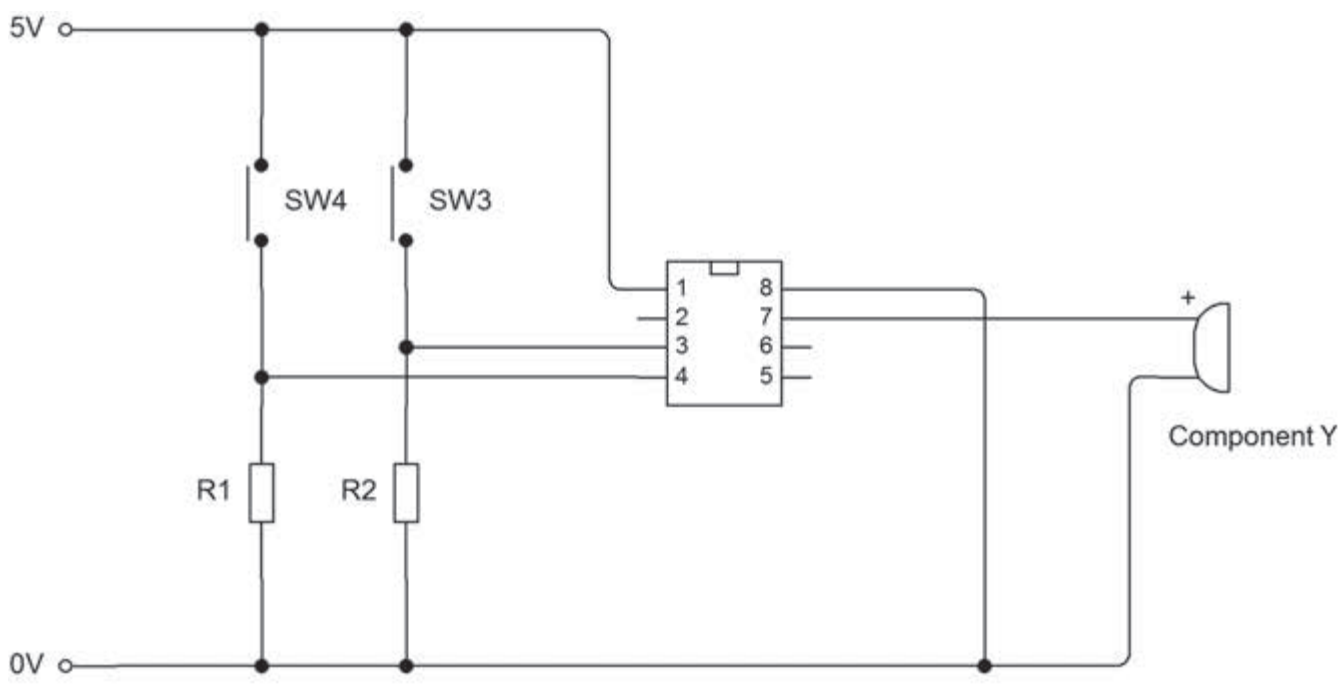
State the name of component Y

(1)

....

(c) The program flowchart for the alarm is almost finished.

- The alarm should sound for one minute if either switch is pressed and then turn off.

- It should also sound for one minute if both are pressed and then turn off.

- When it is not sounding the circuit should be able to detect when a switch is pressed.

(i) Add the remaining **lines** and **arrows** to the flowchart below so the alarm will sound for one minute each time either switch is pressed.

(4)
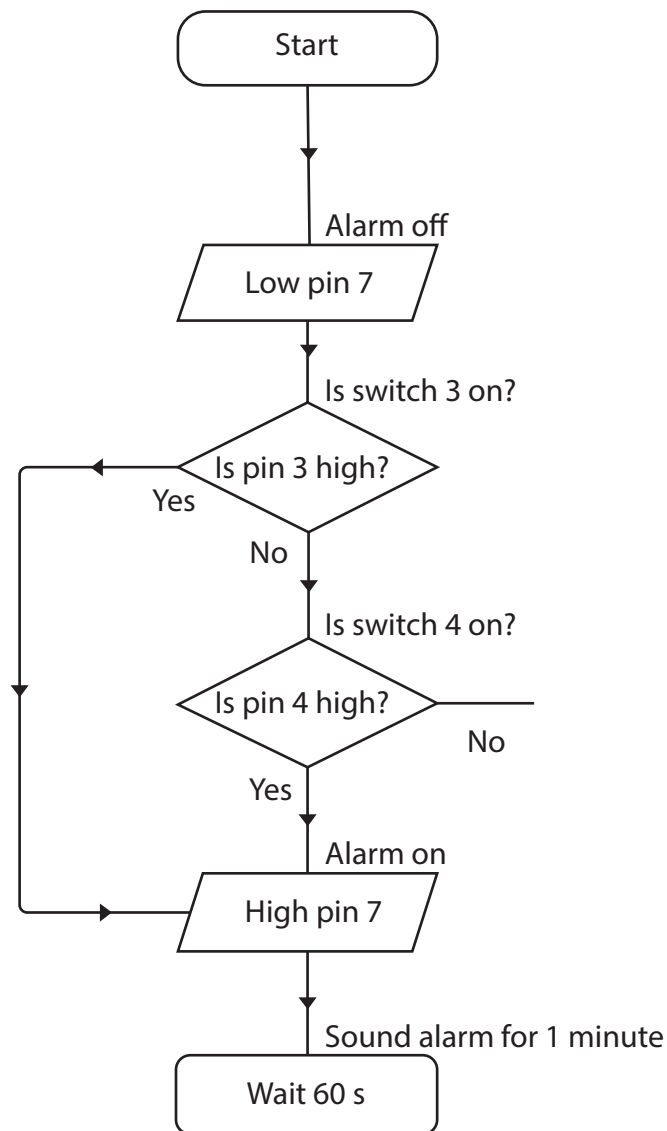
Program flowchart

(ii) The program could be represented by a logic gate.

Add the logic gate symbol to the diagram below.

(1)

```
┌─────────────────────┐
│   SW3 is pressed     │───
└─────────────────────┘
                                        ┌─────────────────────┐
                                     ───│   Alarm sounds       │
┌─────────────────────┐                 └─────────────────────┘
│   SW4 is pressed     │───
└─────────────────────┘
```
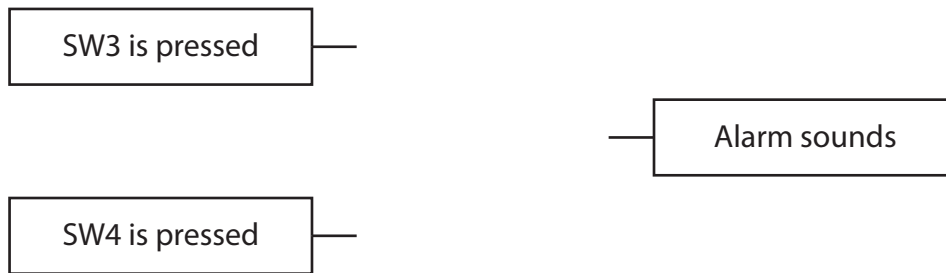
(d) The case for the alarm will be injection moulded.

Give **four** of the main stages in the injection moulding process.

(4)

1 ....

2 ....

3 ....

4 ....

(e) Part of the circuit has been simplified and is shown below.

(i) State the unit of resistance.

(1)

....

(ii) Calculate the total resistance of this circuit.

• Use **one** of the formulae:

$$Rtotal = \frac{R1 \times R2}{R1 + R2} \qquad \text{or} \qquad \frac{1}{Rtotal} = \frac{1}{R1} + \frac{1}{R2}$$

• Show your working.

```
5V ○────────●────────┐
                     │
           R1 ▯     R2 ▯
           10k       10k
                     │
0V ○────────●────────┘
```
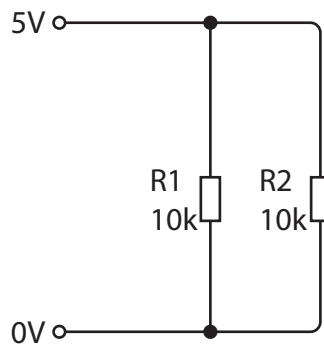
(2)

(iii) Name the way of arranging the resistors to achieve the highest total resistance.

(1)

....

....

(Total for Question 11 = 18 marks)

12 A company is planning to manufacture a fridge alarm. It can be attached inside the fridge and will alert the owner when the fridge door is opened.

Design the fridge alarm only. Do not design any circuits.
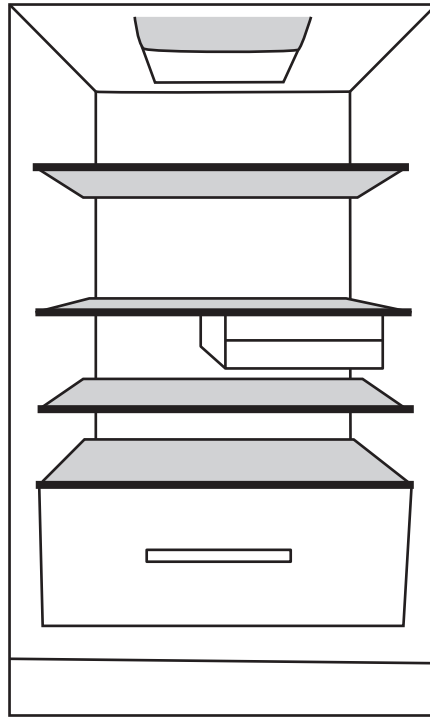
The specification for the fridge alarm is that it must:

• have a food theme

• be easily attachable to and easily removable from most fridges

• sense when the fridge door is opened

• have a suitable internal power source

• be made from a material which can be injection moulded

• have an audible alarm

• have an output component to show when it is on

• have a secure method of switching the alarm on and off.

In the spaces opposite, use sketches and, where appropriate, brief notes to show **two different** design ideas for the fridge alarm that meet the specification points above.

Candidates are reminded that if a pencil is used for diagrams/sketches it must be dark (HB or B).

Coloured pens, pencils and highlighter pens must **not** be used.

PLEASE DO NOT WRITE OR DRAW IN THIS SPACE.

PLEASE USE THE SPACES OPPOSITE FOR YOUR DESIGNS.

Design idea 1

(8)

Design idea 2

(8)

(Total for Question 12 = 16 marks)

13 The fitness band shown in Figure 1 is designed to be worn on the wrist. It is available in one size only and can be used as a watch. It also records fitness data which can be transmitted to other devices such as smart phones or computers where the data can be displayed.

LED dot matrix display

Acrylic screen

Bluetooth®

Rubber wristband
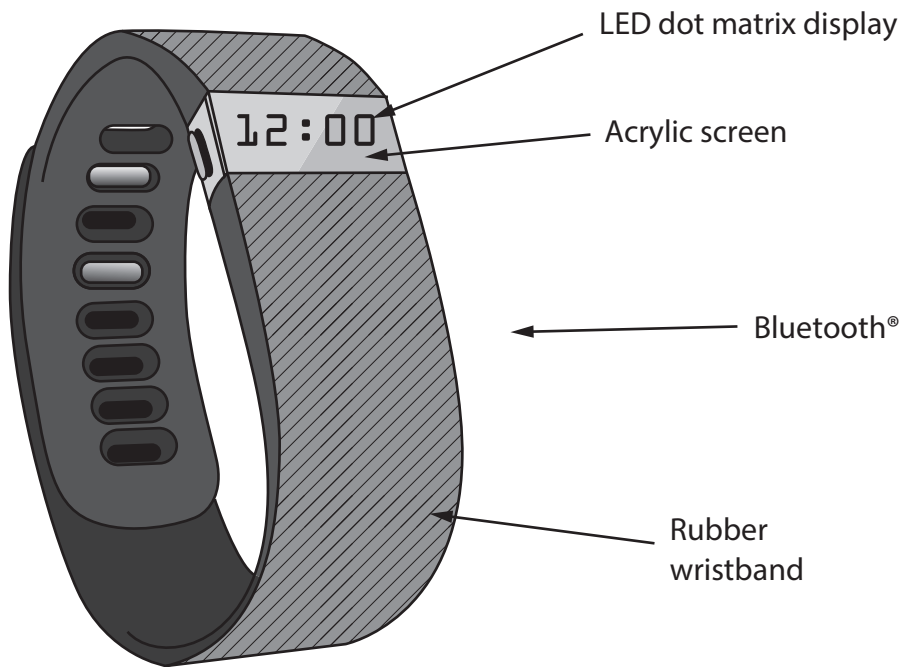
Figure 1

(a) Describe how the properties of the materials/components of the fitness watch, other than acrylic, are successful in meeting the following specification points:

(i) It is comfortable to wear.

(2)

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....

....

....

(ii) It is easy to read.

(2)

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(b) Explain **two** properties of acrylic which make it a suitable material for the fitness watch screen.

(4)

Property 1

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Property 2

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(c) The fitness watch band can be connected wirelessly to other devices using Bluetooth® technology.

Explain one **advantage** and one **disadvantage** of using Bluetooth® to wirelessly connect the fitness watch to another device to transfer data.

(4)

Advantage

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Disadvantage

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*(d) Figure 2 shows another fitness product which is designed to be worn around the chest, next to the skin. It can be linked with compatible gym equipment, mobile phones and computers to give real time or recorded data such as heart rate.

- Wireless connection to phone/computer
- Adjustable elastic fabric strap
- HIPS case
- Printed logo

'John's Fitness'

12:00
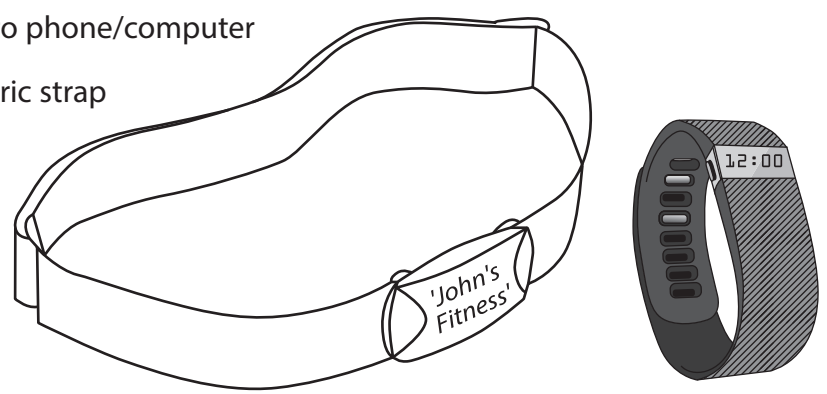
Figure 2

Compare these two products in terms of:

- Form
- User requirements.

(6)

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(Total for Question 13 = 18 marks)

P 4 6 4 8 9 A 0 1 7 2 0

14 A company manufactures timers used in quizzes.

The diagram below shows the monostable circuit which will be used for the timer.
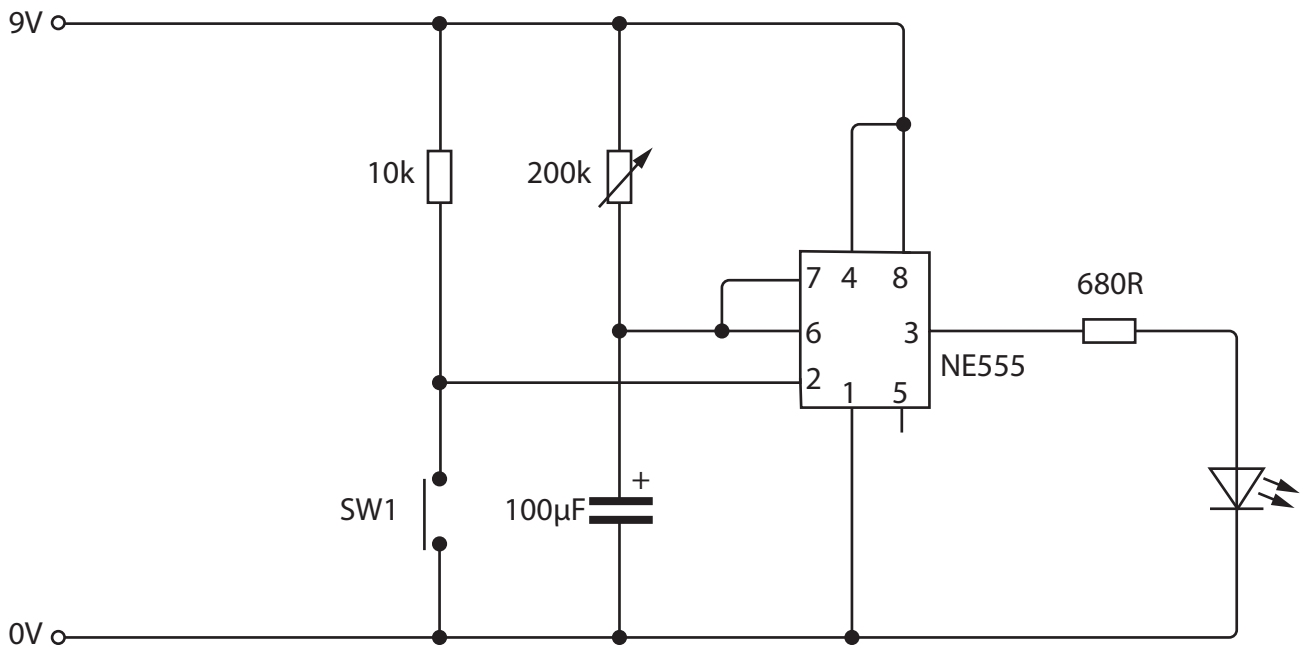
(a) Describe what happens to the LED after SW1 is pressed and released.

(2)

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(b) Give **two** methods of doubling the timing period.

(2)

Method 1

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Method 2

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(c) When the timer is batch produced 'pick and place' technology is used to populate the circuit. The technology is extremely fast and accurate.

Describe **two** other advantages of using pick and place technology to build electronic products.

(4)

Advantage 1

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Advantage 2

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(d) Calculate the time period using the labelled values.

- Show your working

- Include the correct units in your answer

- Use the formula: $T = R \times C$

(4)

The manufacturer will use 'reduce' and 'recover' methods during the production of the timer.

*(e) Evaluate how these methods could minimise the impact on the environment.

(6)

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(Total for Question 14 = 18 marks)

TOTAL FOR PAPER = 80 MARKS