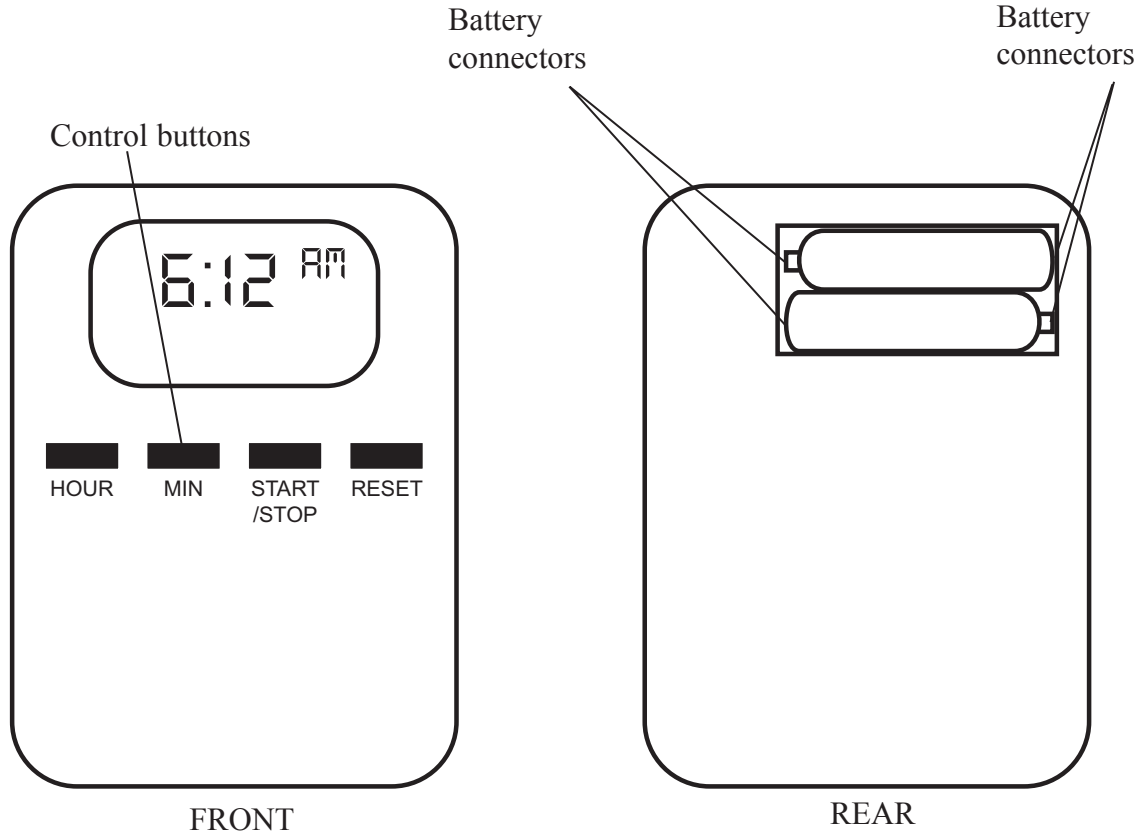


Answer ALL the questions. Write your answers in the spaces provided.

1. The diagrams below show a digital timer.



(a) Two specification points for the timer are that it must be:

- easy to adjust the timing settings
- easy to read the display.

Under each of the following headings, give **one** more point that should be included in the specification for the timer.

For each point, give **one** reason why it should be included.

Quality.

Point

.....

Reason

.....

.....

(2)

Environment.

Point

.....

Reason

.....

.....

(2)

Safety.

Point

.....

Reason

.....

.....

(2)



(b) The timer uses a 7-segment display.

One reason why a 7-segment display is used is because it is readily available.

Give **two** other reasons why a 7-segment display is suitable for this timer.

1

2

(2)

(c) The casing of the timer is manufactured using the injection moulding process.

Give **two** reasons why injection moulding is a suitable process for the manufacture of the casing.

1

.....

2

.....

(2)

(d) The casing is assembled using solvent cement.

Explain **one** reason why solvent cement is used for assembling the casing.

.....

.....

.....

(2)



(e) The battery connectors are made from brass.

Give **two** properties of brass that make it a suitable material for the battery terminals.

For each property give **one** reason why brass is suitable.

Property 1

Reason

.....

Property 2

Reason

.....

(4)

(f) The manufacturer of the batteries uses sampling during production.

Explain **one** reason for sampling during the manufacture of the batteries.

.....

.....

.....

(2)



(g) Two specification points for the timer are that it must be:

- easy to adjust the timing settings
- easy to read the display.

Explain, under the following headings, how the timer satisfies these specification points.

(i) Easy to adjust the timing settings.

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

(2)

(ii) Easy to read the display.

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

(2)

(Total 22 marks)

Q1

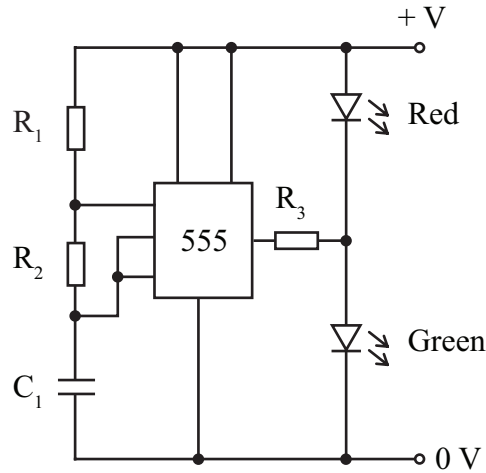
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2. The circuit below shows a 555 timer connected as an astable pulse generator.



(a) Describe the function of R_3 .

.....

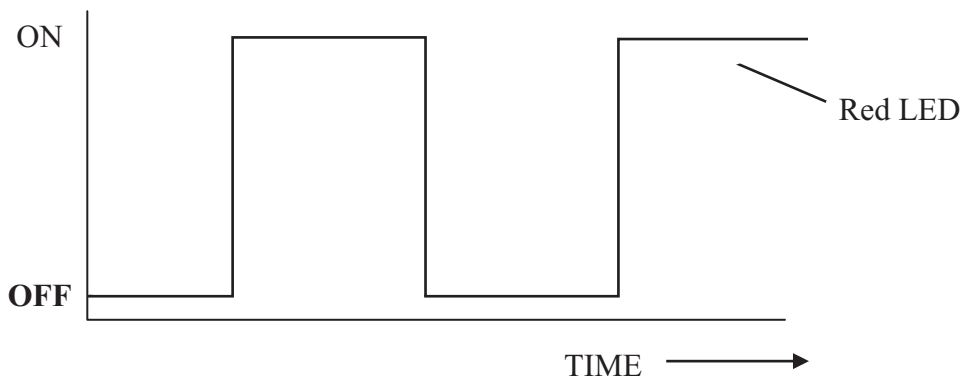
.....

(2)

(b) The graph below indicates when the red LED is on and when it is off.

On the same axes, draw a second graph to show when the green LED is on and when it is off.

(2)



(c) The manufacturer wishes to control the output frequency of the timer.

(i) State **two** components which control the output frequency of the timer.

1

2

(2)

(ii) Describe how the output frequency of this circuit could be made continuously variable.

.....

.....

(2)

(d) When a printed circuit board (PCB) has been produced, components must be inserted.

(i) Name the process used in industry for inserting components on thousands of identical circuits.

.....

(1)

(ii) Describe this process.

.....

.....

(2)

(iii) State **two** benefits to the manufacturer of using standard parts and components.

1

2

(2)

(e) CIM is used in the design, analysis, purchasing, manufacture and distribution of this circuit.

State the meaning of CIM.

.....

(1)



(f) Explain **two** advantages of using CAM rather than assembling circuits by hand.

1

.....

.....

2

.....

.....

(4)

(g) (i) Describe **one** way in which manufacturers use computers to test their circuits.

.....

.....

(2)

(ii) CAD and CAM are two uses of a company's computer systems.

Give **two** other uses of computer systems.

1

2

(2)

Q2

(Total 22 marks)

--	--



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3. A company is designing an electronic greenhouse temperature warning monitor. Its purpose is to alert gardeners when the temperature in a greenhouse moves outside a set temperature range.

The specification for the case of the temperature warning monitor is that it must:

- have an electronic display that can be easily read
- allow a sound output to attract attention
- have easy access to change the battery
- have a means of adjusting the temperature range.

- (a) In the spaces opposite, use sketches and, where necessary, brief notes to show **two different** design ideas for the case of the temperature warning monitor that meet this specification.

Do **not** evaluate your designs in part (a).

Candidates are reminded that if 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)



(b) Three of the specification points are given again below.

Evaluate how **one** of your design ideas succeeds or fails to meet each of these specification points.

Write down the number of your chosen design idea (1 or 2) here:

(i) Have an electronic display that can be easily read.

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

(2)

(ii) Have easy access to change the battery.

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

(2)

(iii) Have a means of adjusting the temperature range.

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

(2)

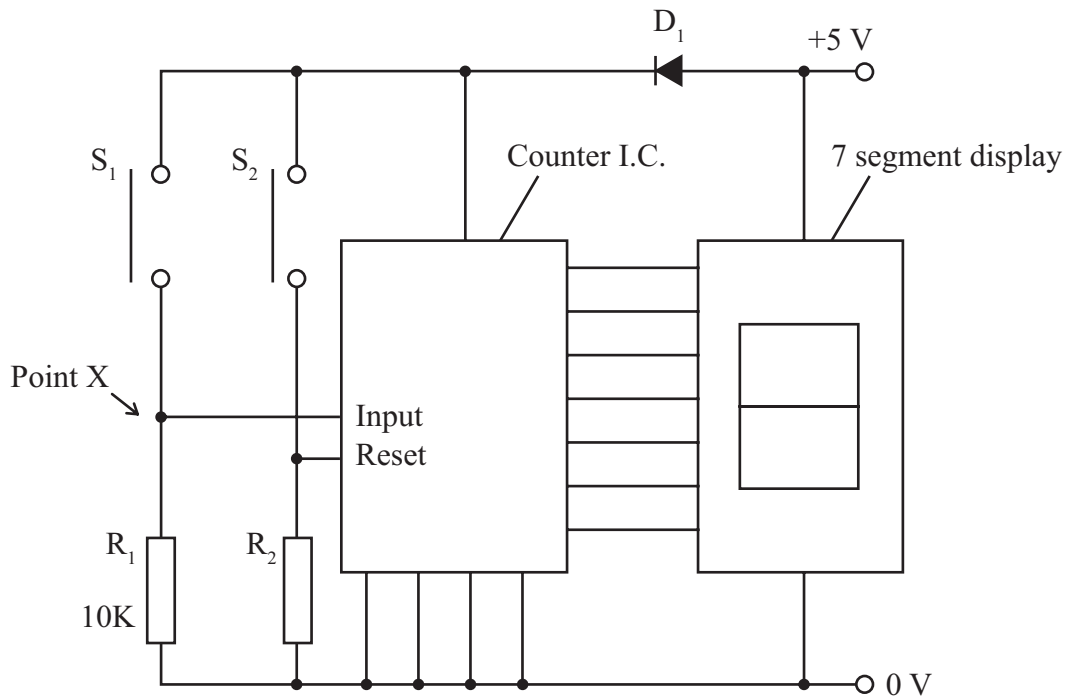
(Total 22 marks)

Q3

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4. The diagram below shows the electronic circuit of a commercially available games scorer which counts from 0 to 9.



(a) Name the type of switch shown as S_1 .

..... (1)

(b) (i) State the effect on the circuit of operating switch S_1 .

..... (1)

(ii) State the effect on the circuit of operating switch S_2 .

..... (1)

(c) Give the voltage at point X on the circuit:

(i) when switch S_1 is closed (1)

(ii) when switch S_1 is open (1)



(d) Use the formula $I = V/R$ to calculate the current through resistor R_1 when switch S_1 is closed. Assume the counter IC draws no current.

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

(2)

(e) D_1 in the circuit is a diode.

The diagrams below show a diode and its circuit symbol.

Use a + sign on **both** diagrams to indicate the polarity of the diode.

(2)



(f) One reason for using a seven-segment LED display is to show the numbers 0 to 9.

Give **two** other reasons for using a seven-segment LED display in this circuit.

1

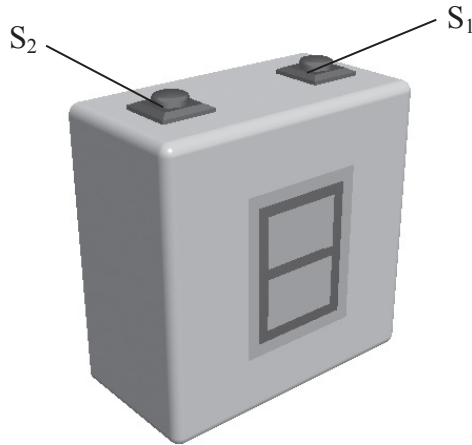
2

.....

(2)



(g) The picture below shows the case of the scorer.



The scorer must conform to British and European safety standards.

Explain **two** benefits to the manufacturer of conforming to these safety standards.

- 1
 -
 - 2
 -
- (4)**

(h) Explain **two** reasons why the manufacturer of the scorer may update the design of the case every six months.

- 1
 -
 - 2
 -
- (4)**

(i) Explain **one** reason why these frequent changes may harm the environment.

-
 -
 -
- (2)**



(j) The scorer will be sold around the world.

Give **one** way in which it could be made to appeal to customers from different cultures.

.....

.....

(1)

Q4

(Total 22 marks)

TOTAL FOR PAPER: 88 MARKS

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