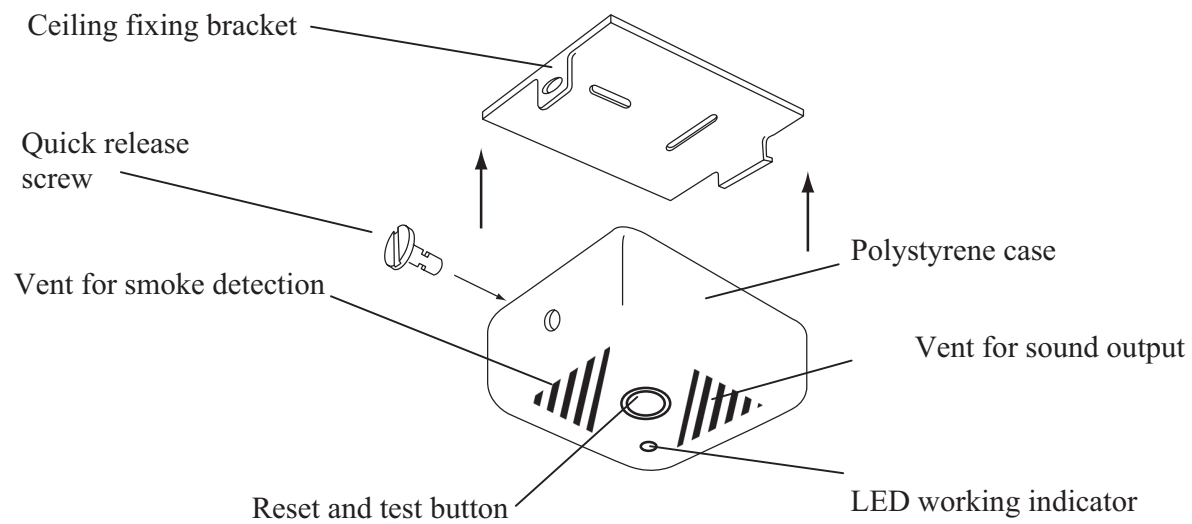


Answer ALL the questions. Write your answers in the spaces provided.

1. The drawings below show details of a smoke alarm.



(a) Two specification points for the smoke alarm are that

- the alarm sound must be clearly heard
- it must have a means of fixing to a ceiling

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

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

(i) **Market**

Point

Reason

(2)

(ii) **Quality**

Point

Reason

(2)

(iii) **Environment**

Point

Reason

(2)



(b) The ceiling fixing bracket for the smoke alarm is made from aluminium.
One reason for using aluminium is that it can be finished using plastic dip coating.

(i) Give **two** other reasons why aluminium is a suitable material from which to make the ceiling fixing bracket for the smoke alarm.

1

2 (2)

(ii) Give **two** reasons why plastic dip coating is a suitable process for finishing the ceiling fixing bracket.

1

2 (2)

(c) The connections between the electronics and the battery of the smoke alarm are made from copper.

Give **two** properties of copper that make it suitable for the connections between the electronics and the battery.

For each property, give **one** reason why it makes copper suitable.

Property

Reason

Property

Reason (4)

(d) Quality control checks are carried out at important stages during the manufacture of the smoke alarm.

Name **two** important electronic quality control checks that should be made during the manufacture of the smoke alarm.

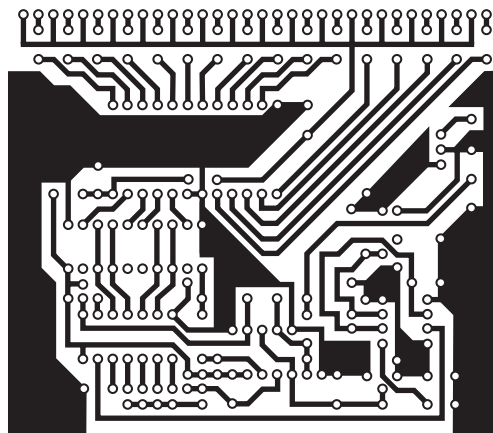
1

2 (2)



Leave blank

(e) The drawing below shows the layout of the tracks for the Printed Circuit Board (PCB) inside the smoke alarm. It is made in batches using the photo-sensitive etching process.



Describe **one** way in which the layout of the tracks makes it suitable to be made in batches using the photo-sensitive etching process.

.....
.....

(2)

(f) Two purposes of the smoke alarm are that

- the alarm sound must be clearly heard
- it must have a means of fixing to a ceiling

Explain, under the following headings, how the smoke alarm achieves these purposes.

(i) The alarm sound must be clearly heard.

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

(2)

(ii) Have a means of fixing to a ceiling.

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

(2)

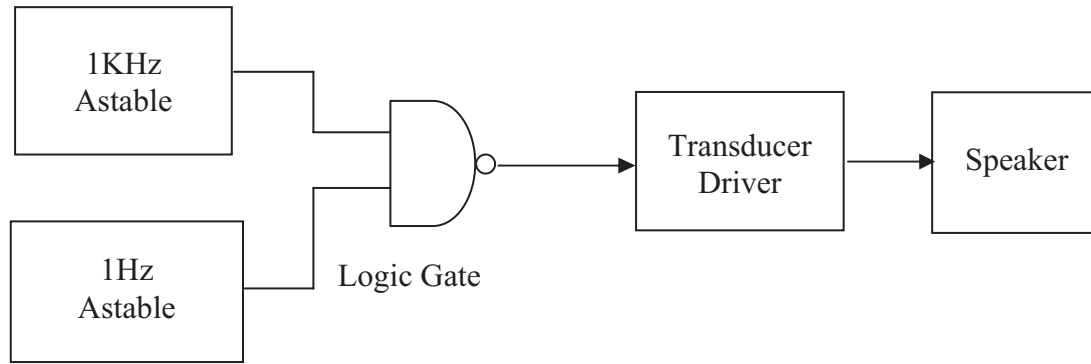
(Total 22 marks)

Q1



2. A warning signal sounds when the guard of a machine is left open. The warning signal is generated by a combination of two Astables and a logic gate.

A simplified block diagram of the warning signal system is shown below.



(a) (i) Name the logic gate in the block diagram.

..... (1)

(ii) Name **one** appropriate electronic device for the 1KHz Astable in the warning signal system.

..... (1)

(iii) Name **one** appropriate transducer driver for the warning signal system.

..... (1)

(b) Describe **two** ways that the warning signal circuit may be prototyped.

1

.....

2

..... (4)



Leave blank

(c) Once tested, a circuit for the warning signal system needs to be batch produced using a 'photo-sensitive' Printed Circuit Board (PCB).

Give the main stages, in the correct sequence, of producing the circuit for the warning signal system using a photo-sensitive PCB.

Some stages have been given.

- Stage 1 Produce the PCB layout mask
- Stage 2
- Stage 3
- Stage 4 Wash and dry the PCB
- Stage 5
- Stage 6 Scrub and dry the PCB
- Stage 7
- Stage 8 Put components in place and solder them to the PCB

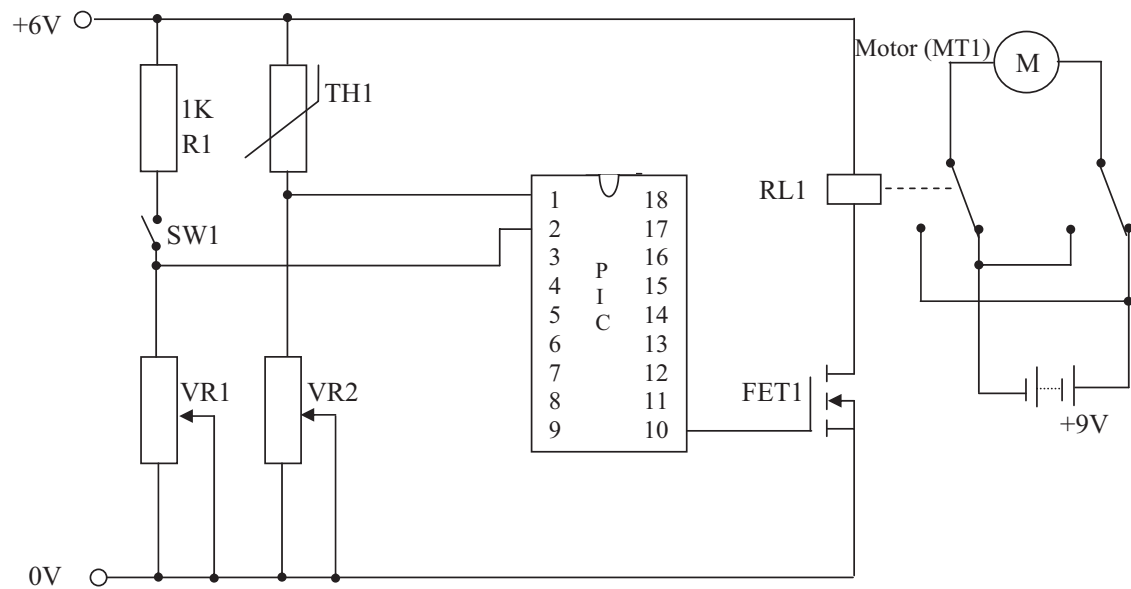
(4)

Q2

(Total 11 marks)



3. (a) A circuit diagram for a greenhouse ventilation system is shown below.



(i) Calculate the voltage on pin 2 of the PIC in the circuit when switch 1 (SW1) is closed.

VR1 is adjusted so that 1mA flows through it.

Use $V = I \times R$

.....
 Volts

(2)

(ii) Explain how the voltage on pin 1 of the PIC in the circuit increases when the temperature rises.

.....

(2)

(iii) Explain the action of the relay when FET1 is switched on by the PIC output at pin 10.

.....

(2)

(iv) State the action of the motor (MT1) when the relay is operated.

.....

(1)



Leave
blank

- (b) The PIC needs to be programmed before the system can work.
The ventilation system closes when the internal temperature drops below 15°C and switch 1 is open.

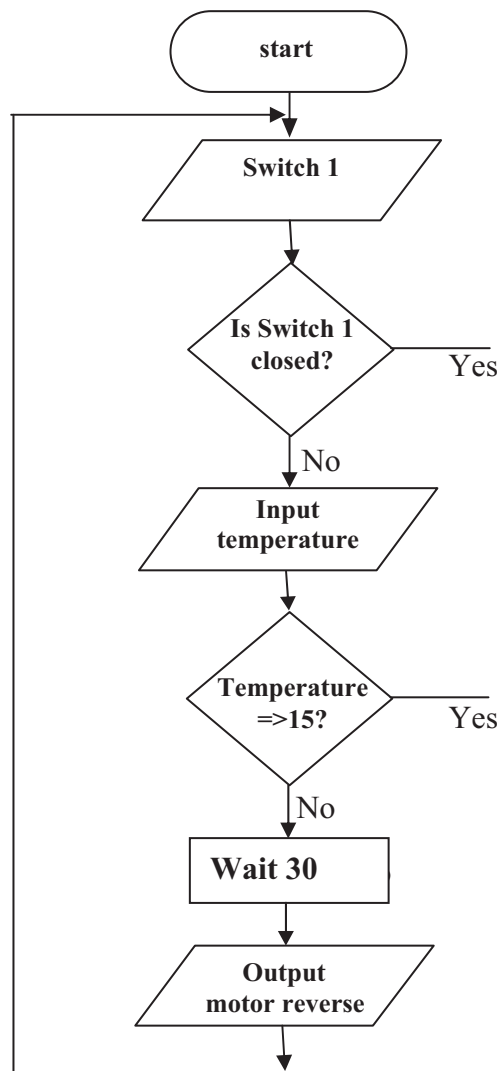
To help with the programming a flowchart should be produced of the operating sequence.

Operating Sequence

1. The output on pin 10 is +5V if either
 - SW1 is closed or
 - the temperature is 15°C or above
2. The output on pin 10 is 0V if both
 - SW1 is not operated and
 - the temperature falls below 15°C
3. There is a 30 second delay before the output on pin 10 changes.



Complete the flowchart to perform this sequential task.
Some stages have been done for you.



Key

- => EQUAL OR GREATER THAN
- START
- PROCESS
- INPUT/OUTPUT
- DECISION

(4)

Q3

(Total 11 marks)

TOTAL FOR PAPER: 44 MARKS

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