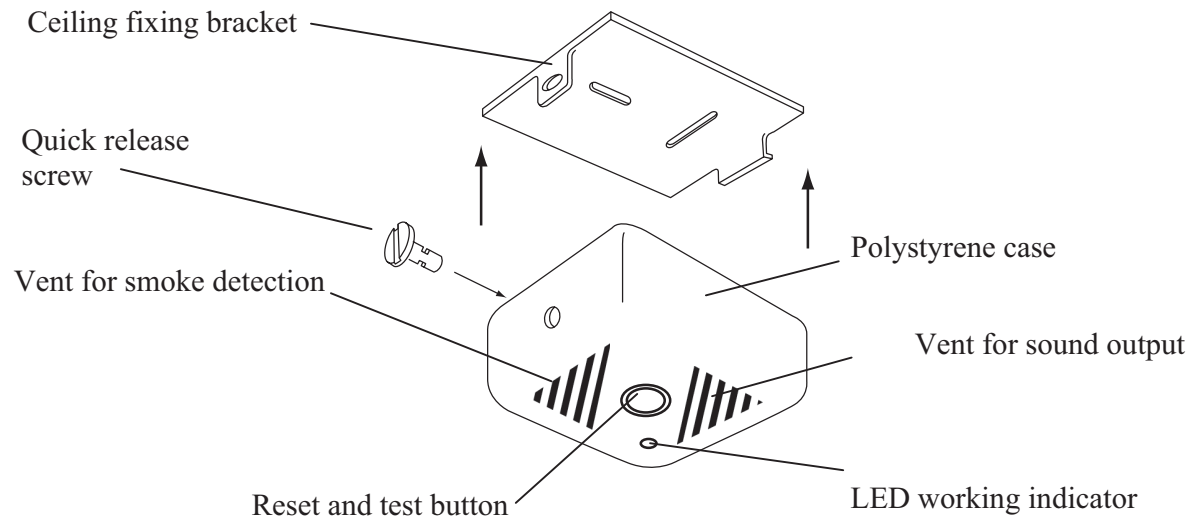


Answer ALL the questions. Write your answers in the spaces provided.

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.

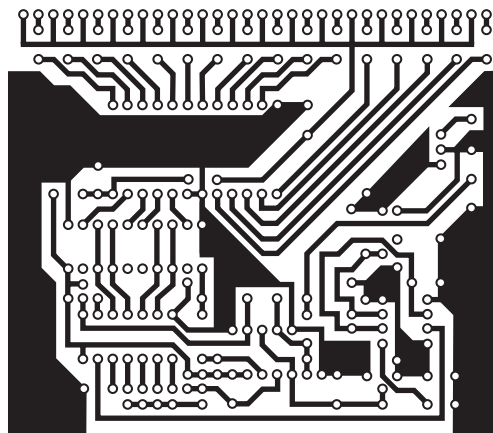
1

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)

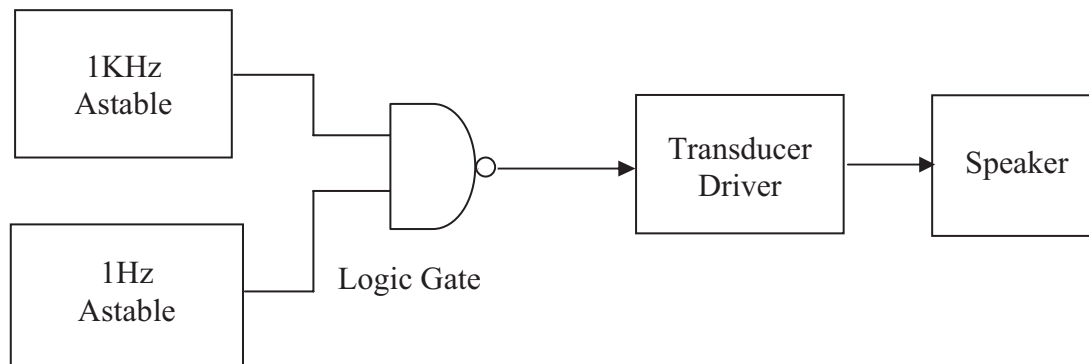
(Total 22 marks)

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)

(d) The components of a PCB can be put in and soldered using CNC automated production methods.

One advantage of using CNC automated production methods is that it eliminates human error.

Explain **two** different advantages, to the manufacturer, of using CNC automated production methods.

- 1
-
- 2
-

(4)



Leave
blank

(e) A manufacturer of electronic systems can buy-in electronic product cases. These cases are made in high volume using the injection moulding process.

Give **three** reasons why the injection moulding process is used to make electronic product cases in high volume.

1

2

3

(3)

(f) An electronic product case is designed using Computer Aided Design (CAD).

One task that CAD can perform is the creation of a 3D virtual product.

(i) Give **two** different tasks which CAD can perform when used to design electronic product cases.

1

2

(2)

(ii) Describe **one** way in which a 3D virtual product can be used in a CAD program to help when designing electronic product cases.

.....

.....

(2)

Q2

(Total 22 marks)



Leave
blank

3. A company is designing automatic warning systems for older cars.

The warning system will automatically warn the driver if a front seat passenger has not fastened their seat belt.

The system will be housed in a case.

The specification for the automatic warning system is that

- the case must fix securely to a surface
- it must have a method of sensing a front seat passenger and if they have not fastened their seatbelt
- it must give a brief audible warning before the car moves away
- the case must be made using materials and processes suitable for batch production

(a) In the spaces opposite, use sketches and, where necessary, brief notes to show **two different** design ideas for the automatic warning system which meet this specification.

Do **not** show electrical/electronic connections in your designs.

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.





<p>Design Idea 1</p>	<p>Leave blank</p>
<hr/> <p>Design Idea 2</p>	<p>(8)</p>



(8)

(8)



N 3 1 1 6 2 A 0 9 1 6



Leave blank

(b) Three of the original specification points are repeated 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) The automatic warning system case must fix securely to a surface.

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

(2)

(ii) The automatic warning system must have a method of sensing a front seat passenger and if they have not fastened their seatbelt.

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

(2)

(iii) The automatic warning system must give a brief audible warning before the car moves away.

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

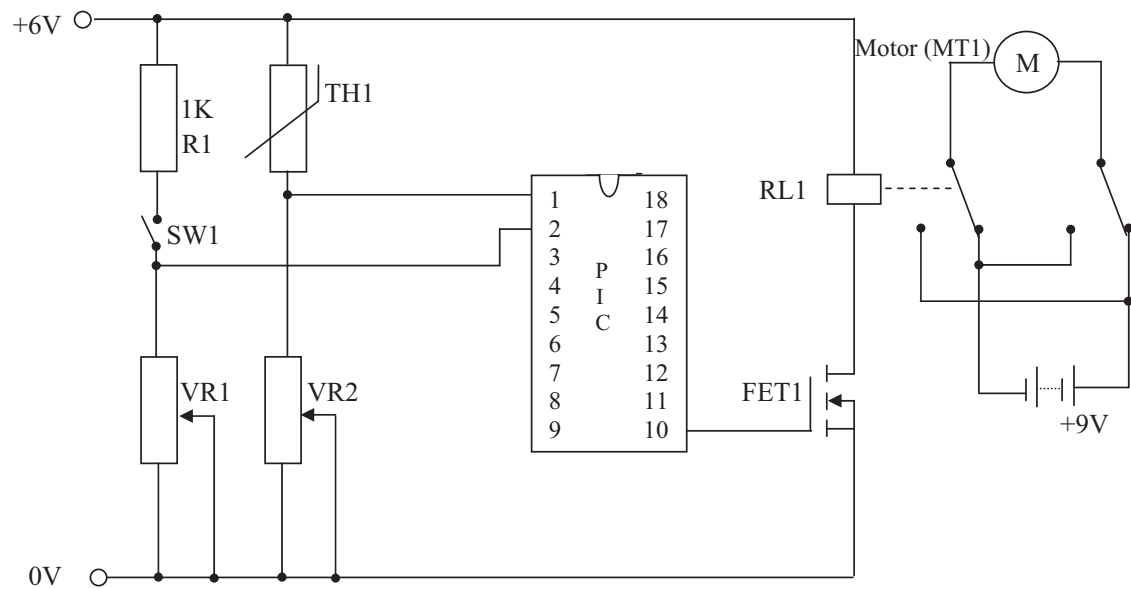
(2)

(Total 22 marks)

Q3



4. (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.

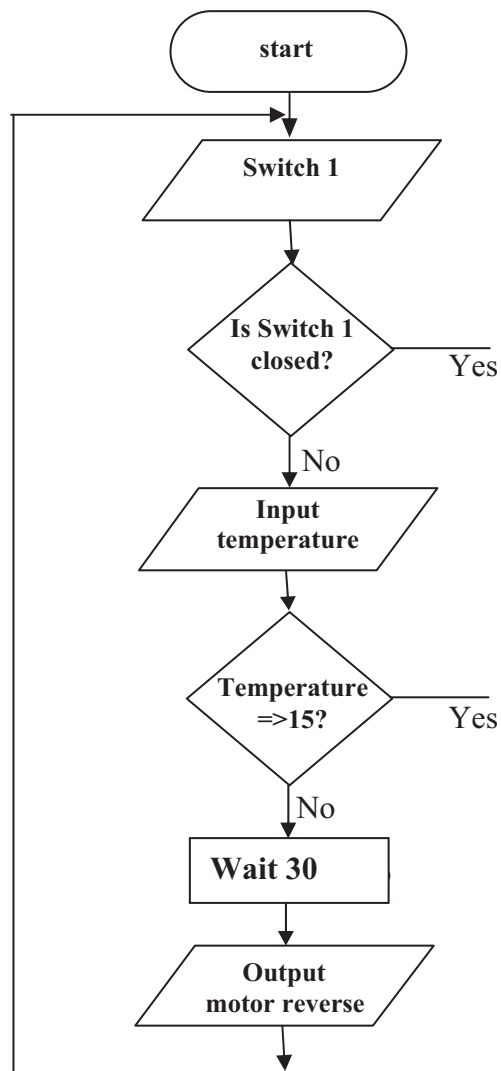
To help with the programming a flowchart should be produced of the operating sequence.

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)



(c) The development of PICs has allowed domestic appliances to have more functions. One example of this is an electric oven that may be controlled for automatic timing.

Describe **two** other ways in which PICs have resulted in domestic appliances having more functions.

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

(d) Electronic products such as domestic appliances are produced using Computer Aided Design (CAD) and Computer Aided Manufacture (CAM). The use of CAD/CAM reduces the cost to the manufacturer of producing electronic products in quantity.

Explain **one** way in which the use of CAD/CAM has made the production of electronic products cheaper.

-
 -
- (2)**

(e) It is often cheaper to buy a new computer printer than to replace its ink cartridges. This is part of planned product obsolescence.

(i) Give **one** moral issue the consumer faces when buying a new computer printer rather than buying more expensive ink cartridge replacements.

-
- (1)**

(ii) Give **two** environmental issues the consumer faces when buying a new computer printer rather than buying more expensive ink cartridge replacements.

- 1
 - 2
- (2)**



(iii) Describe **one** way in which discarded polystyrene ink cartridges can be recycled or reused.

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

(2)

(Total 22 marks)

Leave blank

Q4

TOTAL FOR PAPER: 88 MARKS

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