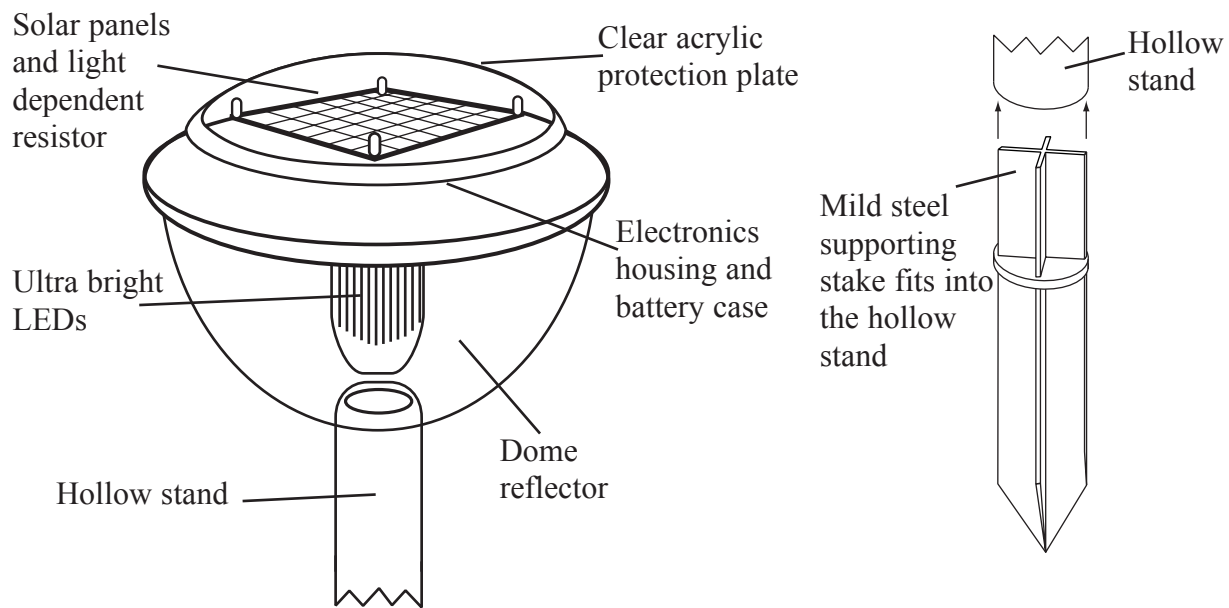


Answer ALL the questions. Write your answers in the spaces provided.

1. The drawings below show details of a garden lamp. It is powered by solar energy and has a supporting metal stake.



(a) Two specification points for the garden lamp are that it must:

- automatically turn on when it is dark
- be able to be installed anywhere in a garden

Under each of the following headings, give **one** more specification point which should be included in the specification for the garden lamp.

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

Market

Point

Reason

.....

.....

Quality

Point

Reason

.....

.....



Leave
blank

Environment

Point

Reason

.....

.....

(6)

- (b) The reflecting dome of the garden lamp is made from clear acrylic. It is waterproof.

Give **two** other reasons why clear acrylic is a suitable material from which to make the reflecting dome.

1

2

(2)

- (c) The reflecting dome is manufactured by blow moulding.

Give **two** reasons why blow moulding is a suitable process to manufacture the reflecting dome.

1

2

(2)

- (d) The electronics housing and battery case is made from rigid polystyrene using injection moulding.

Give **two** properties of rigid polystyrene that make it suitable for the electronic housing and battery case.

For each property give **one** reason why it makes rigid polystyrene suitable.

Property 1

Reason

Property 2

Reason

(4)



Leave
blank

(e) The electronic housing and battery case is made using black polystyrene.

Explain **one** reason, other than looks, why black polystyrene is used to make the electronic housing and battery case.

.....
.....

(2)

(f) The mild steel supporting stake for the garden lamp is finished using plastic dip coating.

Explain **one** reason why plastic dip coating is used to finish the supporting stake.

.....
.....

(2)

(g) Two purposes of the garden lamp are that it must:

- automatically turn on when it is dark
- be able to be installed anywhere in a garden

Explain, under the following headings, how the garden lamp achieves these purposes.

(i) Automatically turn on when it is dark.

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

(2)

(ii) Be able to be installed anywhere in a garden.

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

(2)

(Total 22 marks)

Q1

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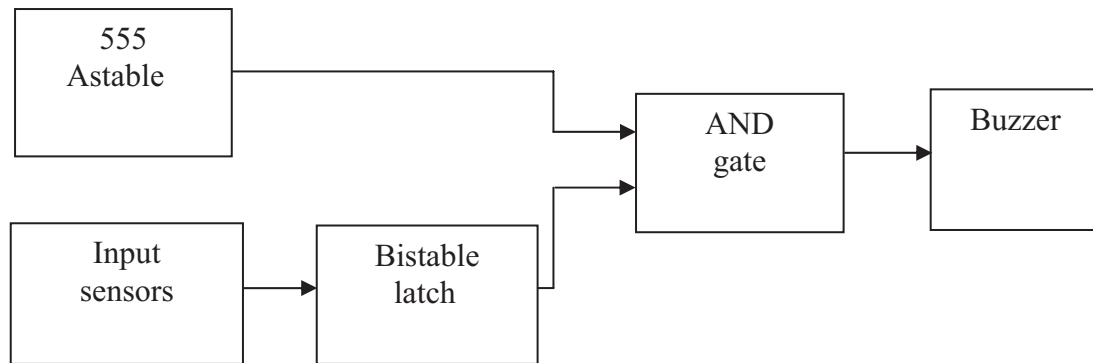


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2. A designed bicycle alarm contains a combination of logic gates and a timer circuit to make it work.

Shown below is a simplified block diagram of the bicycle alarm system.



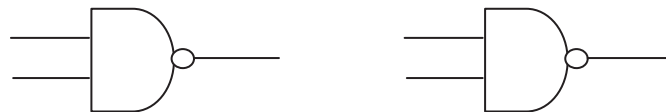
(a) A Quad 2 input NAND gate is needed to create the AND gate and the Bistable.

(i) Complete the truth table for a NAND gate.

I/P 1	I/P 2	O/P
0	0	
0	1	
1	0	
1	1	

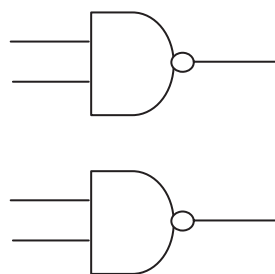
(4)

(ii) Complete the diagram below to show how two NAND gates in combination can produce an AND gate.



(1)

(iii) Complete the diagram below to show how two NAND gates in combination can produce a Bistable.



(2)



(b) When the output of the AND gate was connected to the buzzer the circuit did not work.

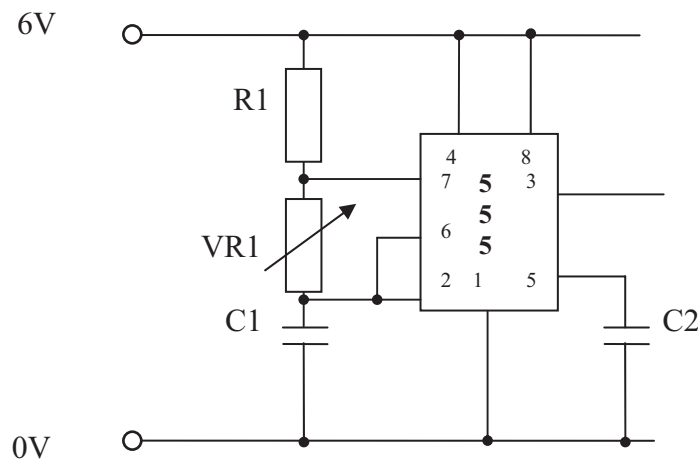
(i) Explain the reason why a buzzer connected directly to an integrated circuit will not work.

.....
.....
(2)

(ii) Describe **one** way in which a **named** interface device may be used to drive the buzzer.

.....
.....
(2)

(c) The circuit diagram below shows a 555 timer used as an Astable.



The circuit needs to be prototyped before batch production.

(i) Explain **one** reason for prototyping the circuit.

.....
.....
(2)

(ii) One method of prototyping the circuit is by using computer modelling.

Give **three** ways in which computer modelling of the circuit can make its design and manufacture more efficient.

- 1
 - 2
 - 3
- (3)



Leave blank

(d) The batch produced case for the bicycle alarm would be designed using computer aided design (CAD).

Give **two** ways in which CAD could be used to model the case for the bicycle alarm.

1

2

(2)

(e) It is possible to use computer testing of manufactured electronic circuits.

Explain **one** reason for using computer testing of batch produced electronic circuits.

.....

.....

(2)

(f) Computer Integrated Manufacture (CIM) is used to make batches of the cycle alarm.

Give **two** advantages to the manufacturer of using CIM to make batches of the cycle alarm.

1

2

(2)

Q2

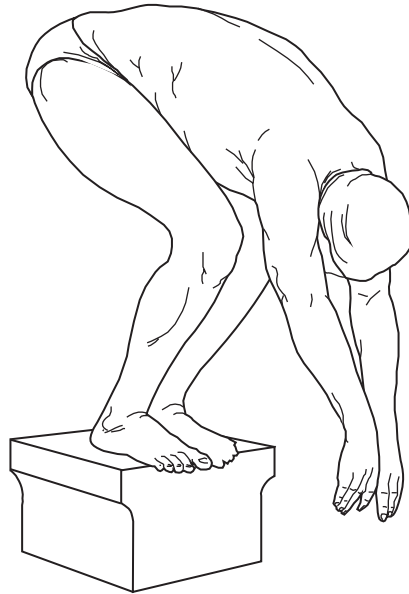
(Total 22 marks)



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3. A company is designing a system to help swimmers train alone.
The system will be housed in a case.



The specification for the swimmers' training system is that it must:

- be housed in a portable casing that will stand on the side of the pool
- have a method of switching on and a method to give an audible signal for starting
- have a method of detecting and giving a visual indication of a false start
- be made from 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 swimmers' training system that 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 that it is dark (HB or B). Coloured pens, pencils and highlighter pens must **not** be used.

Please do not write in the space below. Please write your answers in the spaces provided opposite.



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 swimmers' training system must be housed in a portable casing that will stand on the side of the pool.

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

(2)

(ii) The swimmers' training system must have a method of switching on and a method to give an audible signal for starting.

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

(2)

(iii) The swimmers' training system must have a method of detecting and giving a visual indication of a false start.

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

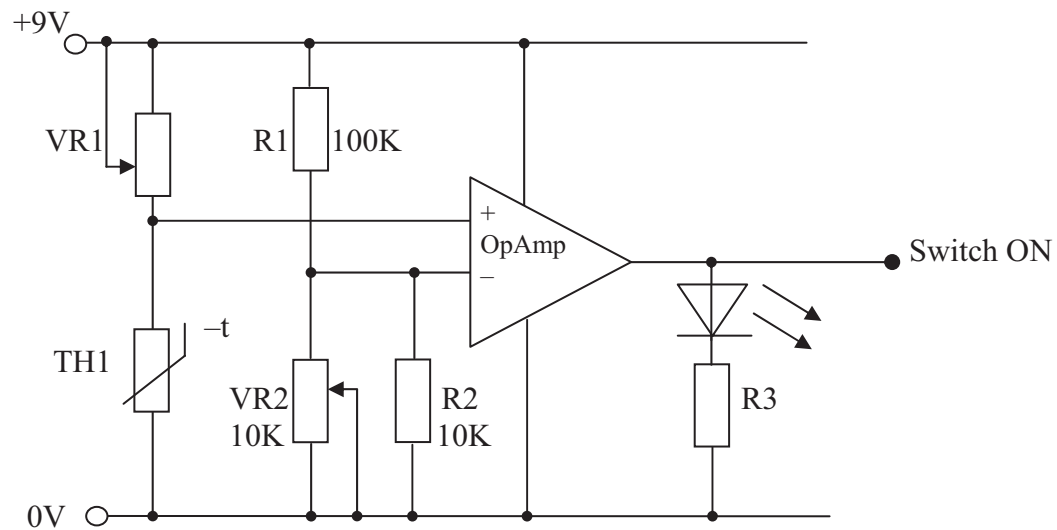
(2)

Q3

(Total 22 marks)



4. (a) The circuit, shown below, is the control system for an air conditioning unit.



(i) Give **one** reason for using VR1 in the circuit.

.....
(1)

(ii) Describe the action of thermistor (TH1) in the circuit when the temperature becomes colder.

.....
.....
.....
(2)

(iii) Describe the action of the operational amplifier (OpAmp) in the circuit when the voltage applied to its non-inverting input (+) is larger than that applied to the inverting input (-).

.....
.....
.....
(2)

(iv) Calculate the current passing through R1 if the voltage at the inverting input (-) of the OpAmp is set at 1V.

Use the formula: $I = V/R$

.....
(2)



(v) VR2 and R2 are in parallel and are used to set the voltage at the inverting input (-) of the OpAmp.

Calculate the total resistance of VR2 and R2 when VR2 is adjusted to its maximum value.

Use the formula: $\frac{R1 \times R2}{R1 + R2}$

.....
(2)

(vi) Explain the reason for using R3 in the circuit.

.....
.....
.....
(2)

(b) The manufacturers of the air conditioning unit control system also make control systems for other domestic appliances. The manufacturers are considering redesigning their control circuits using Programmable ICs (PICs).

(i) Explain **two** advantages of using PICs for electronic control systems.

1
.....
2
.....
(4)

(ii) Explain **one** disadvantage of using PICs for electronic control systems.

.....
.....
.....
(2)



Leave
blank

(c) Give **one** environmental advantage of using control systems in domestic appliances.

.....
(1)

(d) Describe **two** ways in which old electronic control system circuits may be recycled or reused.

1

.....

.....

2

.....

.....

(4)

Q4

(Total 22 marks)

TOTAL FOR PAPER: 88 MARKS

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