GCSE

3601U10-1

TUESDAY, 18 JUNE 2024 – MORNING

DESIGN AND TECHNOLOGY

Unit 1

ENGINEERING DESIGN

2 hours plus your additional time allowance

Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**10**	
2.	**10**	
3.	**15**	
4.	**20**	
5.	**20**	
6.	**25**	
Total	**100**	

ADDITIONAL MATERIALS

A calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

Answer ALL questions.

Additional space is provided for some questions within the booklet (if required). If further space is required for any question, you should use the lined page(s) at the end of this booklet. The question number(s) should be clearly shown.

INFORMATION FOR CANDIDATES

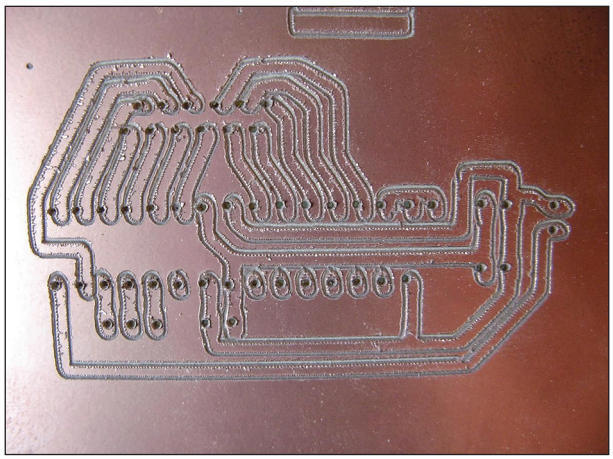
The number of marks is given in brackets at the end of each question or part-question. You are advised to divide your time accordingly.

The total number of marks available is 100.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to questions 5(a) and 5(c).

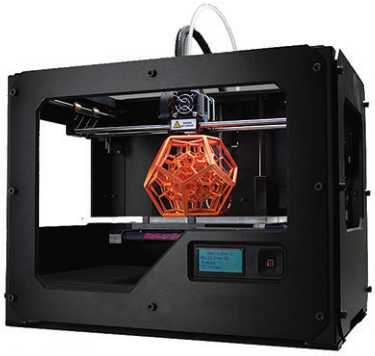
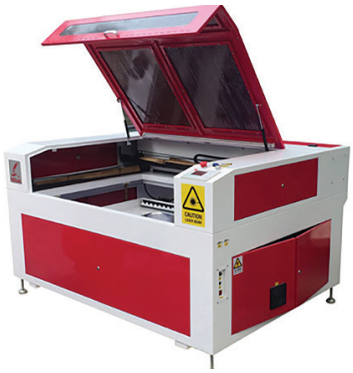
Answer ALL questions.

1. The image below shows a circuit board, manufactured using CNC (Computer Numeric Control).



(a) Describe ONE disadvantage of using CNC to manufacture a circuit board. [2 marks]

1 (b) Name the FOUR CAM (Computer Aided Manufacture) machines shown below. [4 marks]

	
_____	_____
	
_____	_____

1 (c) Explain TWO advantages of additive CAM manufacture.

Advantage 1: _____

_____

_____

_____

_____

_____

[2 marks]

Advantage 2: _____

_____

_____

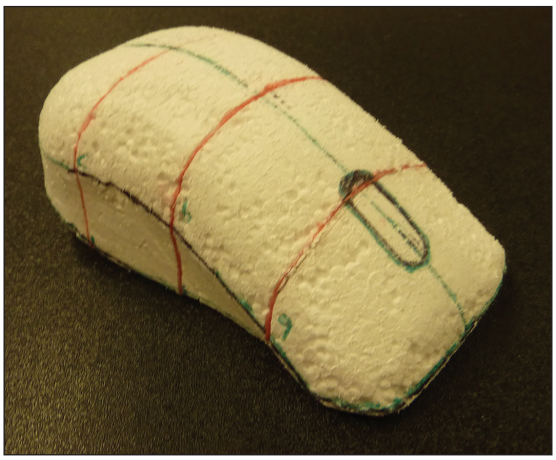
_____

_____

_____

[2 marks]

2. The image below shows a styrofoam concept model of a wireless computer mouse.



(a) Describe ONE advantage of using styrofoam when making prototype models. [2 marks]

2 (b) Explain TWO ergonomic considerations when modelling the computer mouse. [4 marks]

Consideration 1: _____

_____

_____

_____

_____

_____

Consideration 2: _____

_____

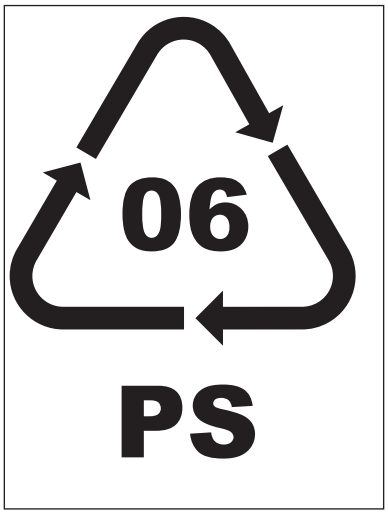
_____

_____

_____

_____

2 (c) Styrofoam carries the symbol below.



(i) State which of the 6Rs this symbol represents.

[1 mark]

(ii) Polymers are often produced using crude oil. Circle the word below that best describes crude oil. [1 mark]

Biodegradable Non-renewable Renewable

2 (c) (iii) Manufacturers are moving away from oil-rich polymers and developing plant-based polymers. Explain ONE environmental advantage for this technological advancement. [2 marks]

3. **The images below show a Bluetooth wireless shower speaker.**

(a) **State TWO important factors that would need to be considered when designing the Bluetooth wireless shower speaker. 2 × [1 mark]**

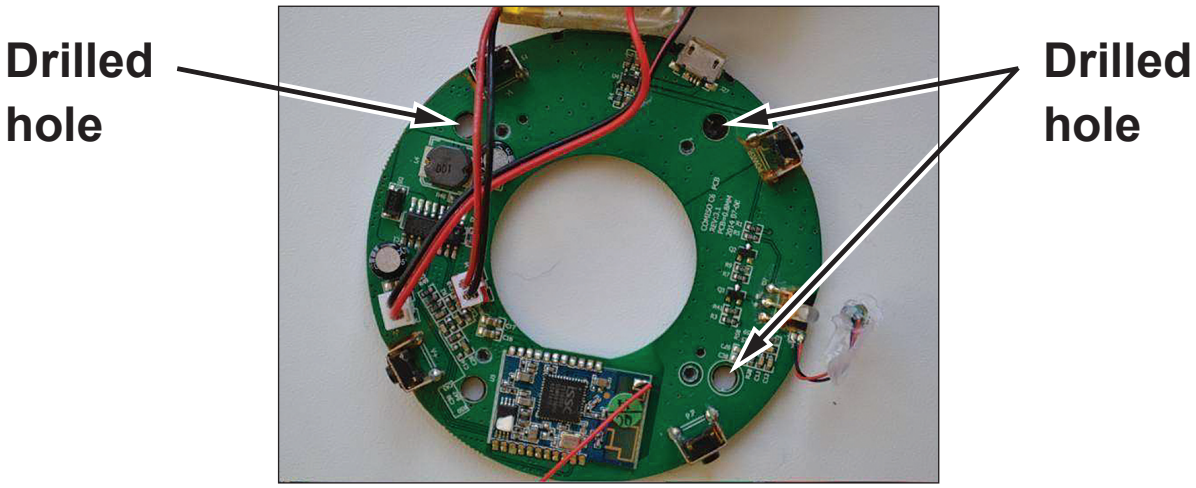
Factor 1: _____

Factor 2: _____

3 (b) Explain the advantages of using aluminium for the mesh on the Bluetooth wireless shower speaker.

[4 marks]

3 (c) The image below shows the PCB used in the Bluetooth wireless shower speaker.



(i) State what the term PCB stands for. [1 mark]

P _____

C _____

B _____

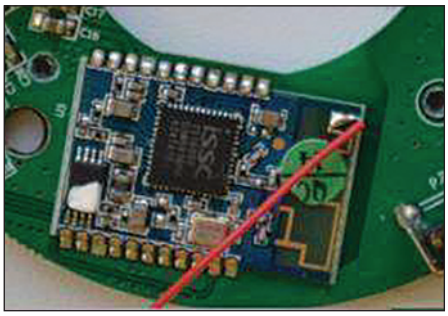
(ii) The image shows holes drilled in the PCB. State the reason why the manufacturer has used these on the PCB. [1 mark]

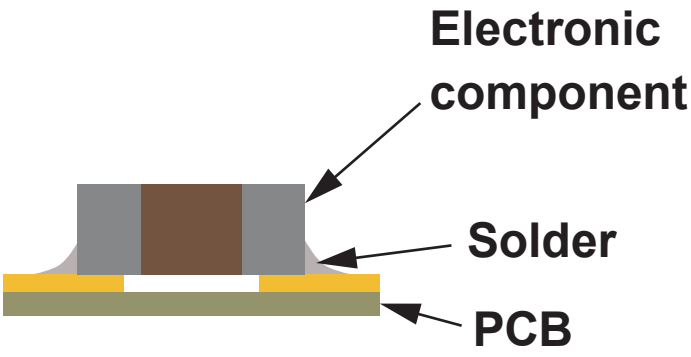
_____

_____

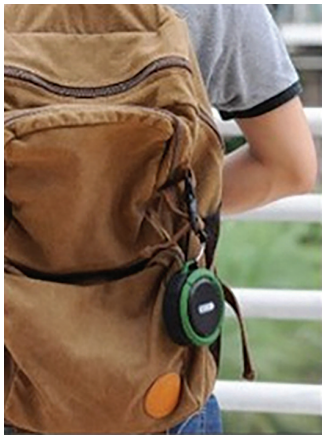
3 (c) (iii)

Explain ONE reason for the use of SMT (Surface Mounted Technology) on the Bluetooth wireless shower speaker PCB. [2 marks]





3 (d) The images below show developments of the Bluetooth speaker. Study the images and analyse how the developments have had an impact on sales. [5 marks]



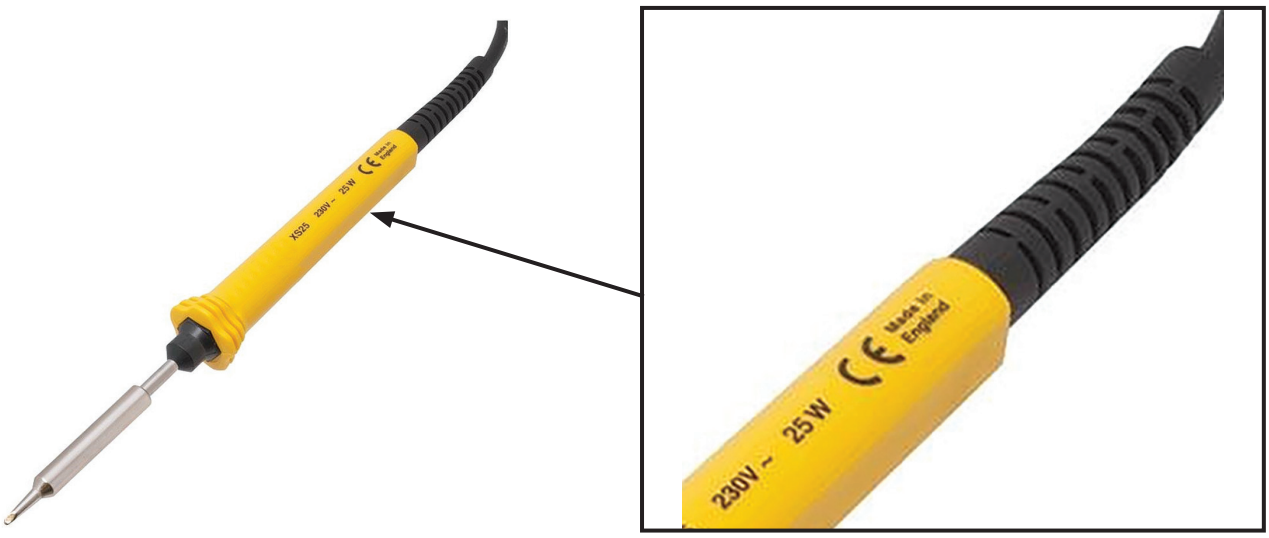
Supports external memory card

The Bluetooth speaker is able to stick to the car window using a rubber sucker

4. **The image below shows a typical design and technology soldering iron station set-up.**

(a) **Analyse the safety of the soldering iron station set-up. [5 marks]**

4 (b) The images below are of a typical soldering iron found in Engineering Design lessons.



(i) Describe the benefit, to the consumer, of using a soldering iron that carries the CE mark. [2 marks]

4 (b) (ii)

Explain TWO tests that would have been carried out to enable the soldering iron to gain a CE mark.

2 × [2 marks]

Test 1: _____

_____

_____

_____

_____

_____

Test 2: _____

_____

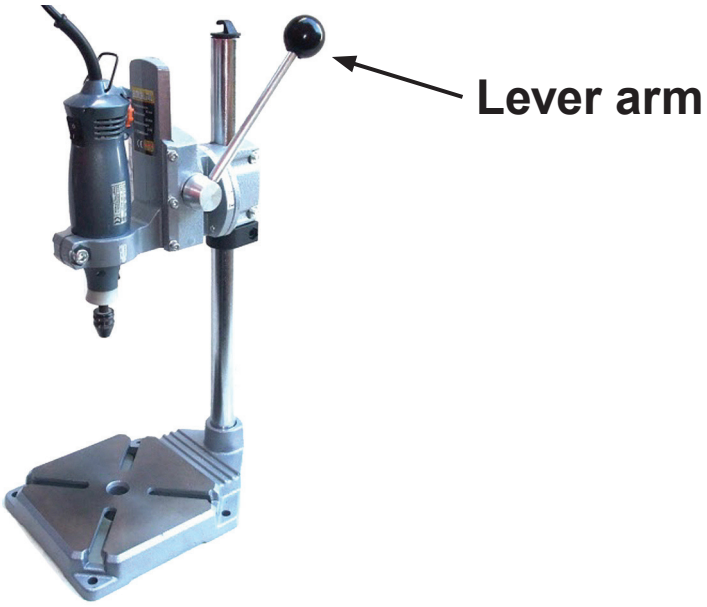
_____

_____

_____

_____

4 (c) The image below shows a PCB precision drill and stand.



(i) The PCB precision drill stand makes use of a lever to operate it. Explain ONE benefit for this mechanical part. [2 marks]

4 (c) (ii) Describe the impact of reducing the length of the lever arm when drilling. [2 marks]

(iii) Explain why cast iron is a suitable material for the base of the drill stand. [2 marks]

4 (c) (iv)

Explain the basic process of casting. [3 marks]

5. (a) The image below shows a bike tyre. Evaluate the use of Kevlar in bike tyres, compared to traditional rubber. [5 marks]

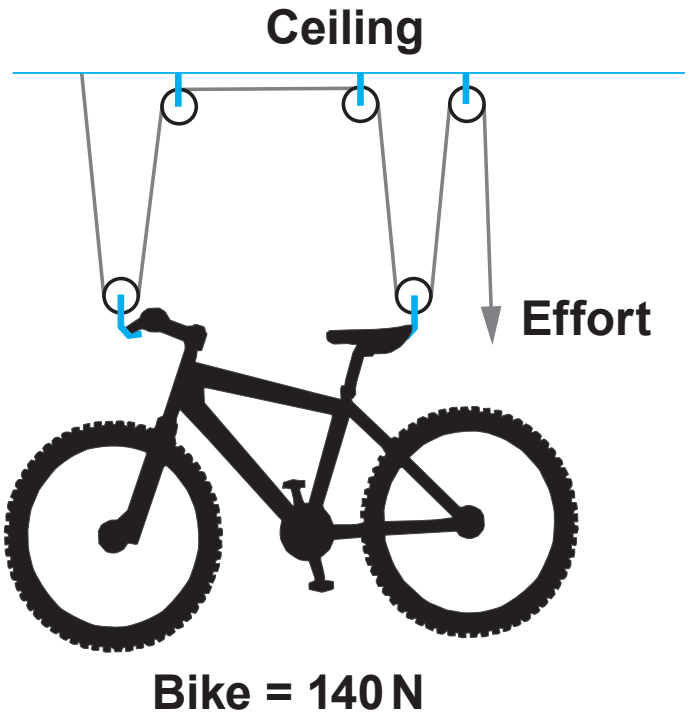
Marks will be awarded for the content of the answer and the quality of written communication.

5 (b) The image below shows a bike hoist storage system.

(i) Explain ONE advantage of using nylon for the pulley wheels. [2 marks]

5 (b) (ii)

The bike hoist system below has a mechanical advantage of 4:1.



Calculate the force required to lift the bike.

[3 marks]

Show all workings.

_____

_____

_____

5 (b) (iii) **If the rope is pulled 5 metres, how high has the bike been hoisted? [1 mark]**

_____

(iv) **In the space below and on the next page, use notes and sketches to design a safe mechanical method to enable the user to wind the cord in, rather than pulling it. [4 marks]**

5 (c) The image below shows a ceiling bracket and pulley for the hoist. Evaluate the benefits of stamp pressing this component. [5 marks]

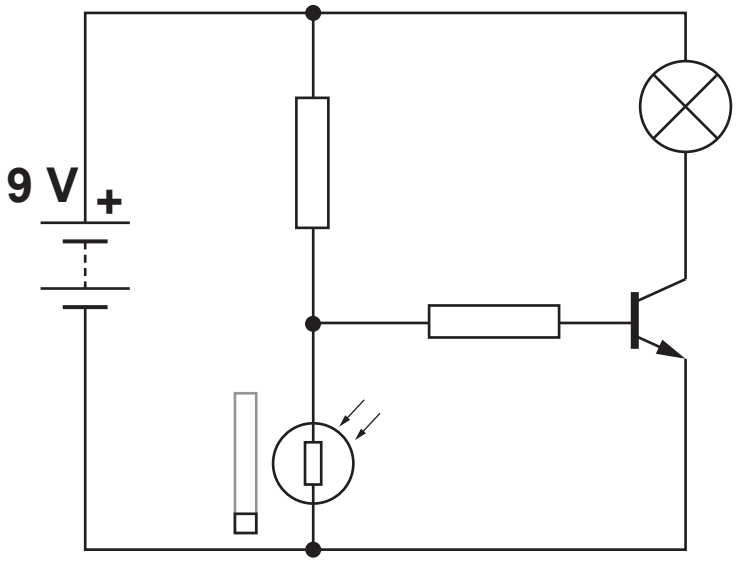
Marks will be awarded for the content of the answer and the quality of written communication.

6. **The image below is of a traffic safety cone with a light-activated warning lamp.**

(a) **The warning lamp casing is made from polyvinyl chloride (PVC). Explain ONE reason why PVC is a suitable material for the warning lamp casing.**

[2 marks]

6 (b) Analyse the circuit diagram below used in the warning lamp.



(i) Name the input component:

_____

[1 mark]

(ii) Name the output component:

_____

[1 mark]

6 (b) (iii)

Describe the purpose of the transistor in the warning lamp circuit. [2 marks]

_____

_____

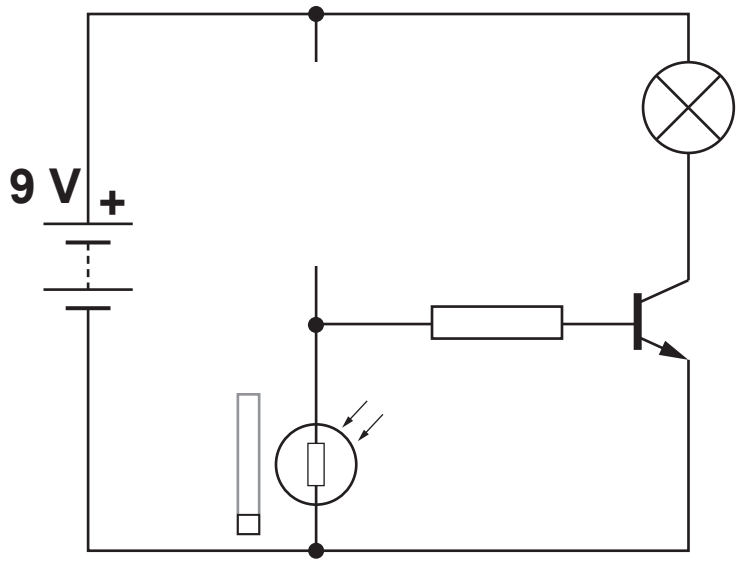
_____

_____

(c) In the space below and on the next page, show details of how the cone could be re-designed to make the lamp and cone one complete design. [6 marks]

6 (d) (i)

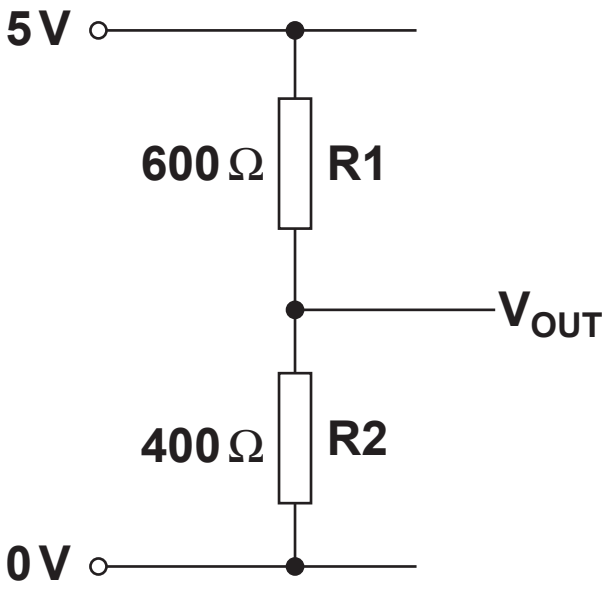
Complete the circuit below, by adding the missing component, to allow the sensitivity to be adjusted and explain the reason for your choice of component. [3 marks]



Reason:

6 (d) (ii)

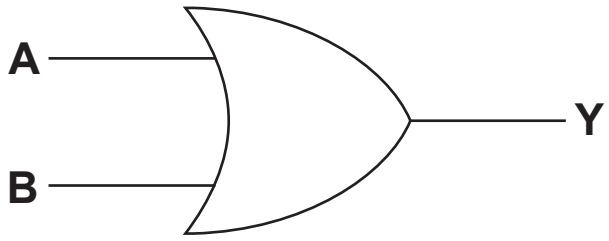
Use the diagram below. Calculate the voltage at V_{OUT}. [2 marks]



Show all workings.

6 (e) (i)

Name the logic gate below.



_____

[1 mark]

(ii) Complete the truth table for an AND gate below.

[4 marks]

A	B	Y
0	0	
1	0	
0	1	
1	1	

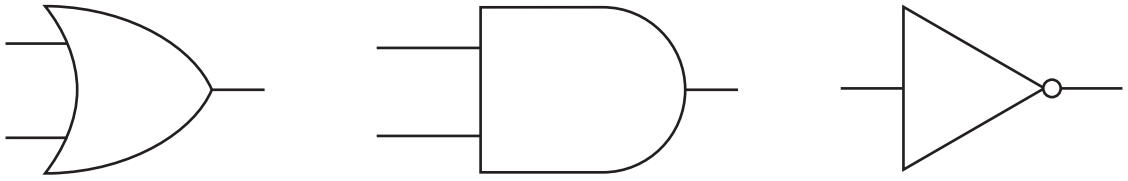
6 (e) (iii)

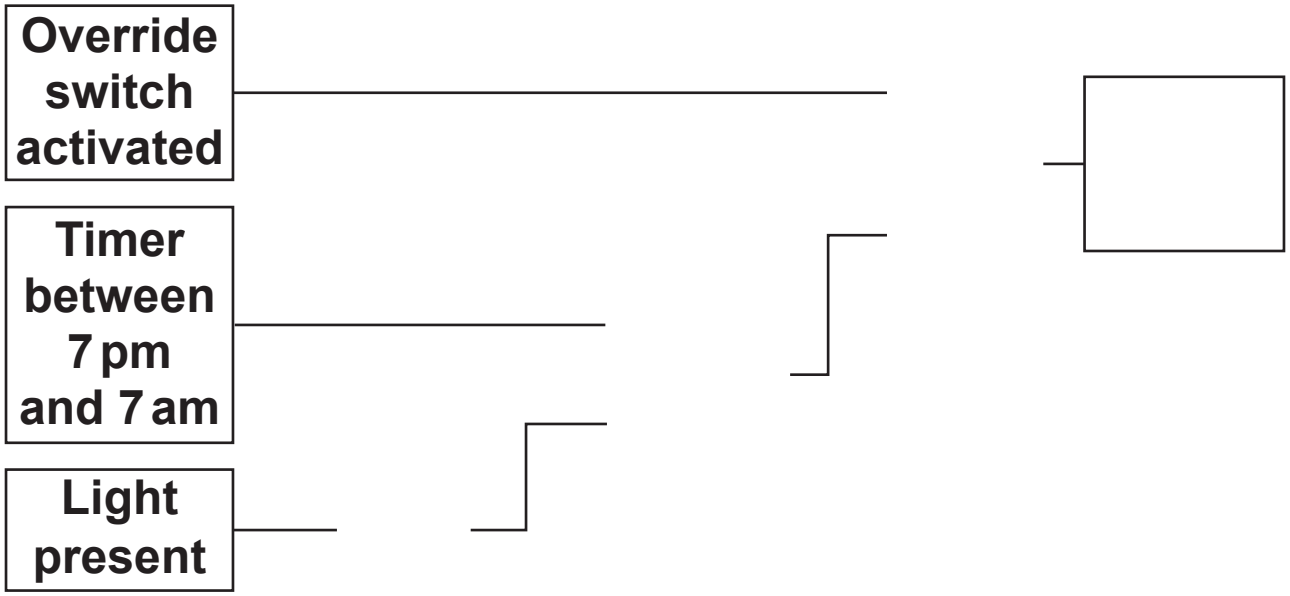
Using the THREE logic gate symbols shown below, complete the warning lamp logic diagram to meet its new specifications. [3 marks]

NEW WARNING LAMP SPECIFICATIONS:

The warning lamp has been modified to come on:

- **when the warning lamp sensor is in darkness**
- **between the hours of 7 pm and 7 am**
- **if an override switch is activated.**





END OF PAPER

Question number	Additional page, if required. Write the question numbers in the left-hand margin.