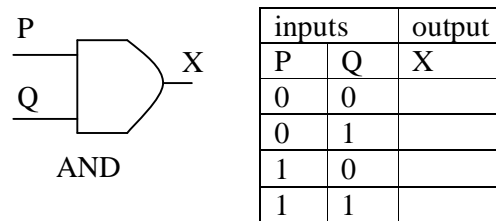
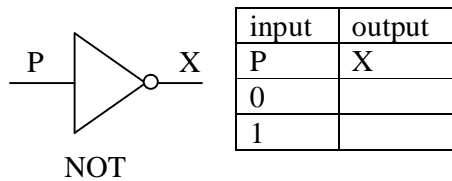


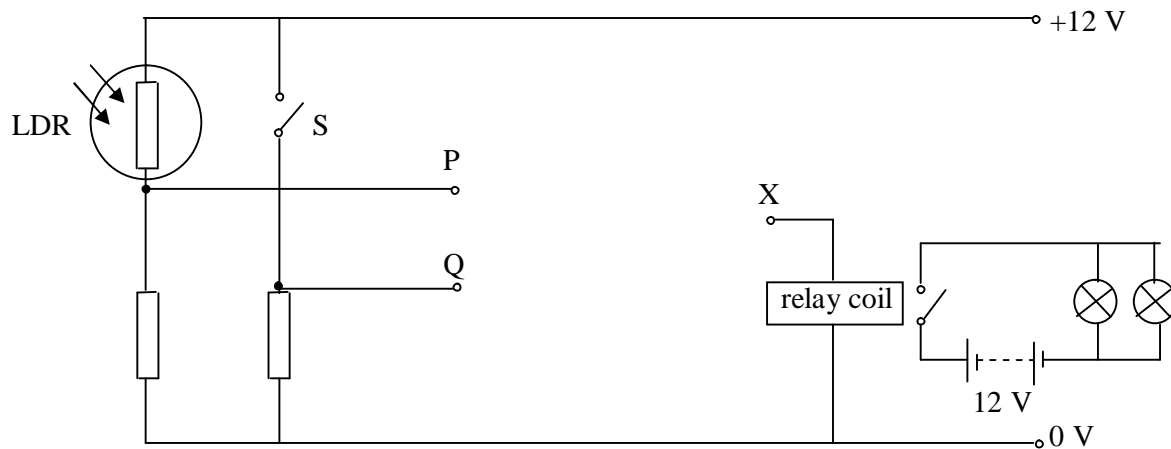
## Logic Gate Questions

1 This question is about NOT and AND logic gates.

(a) Complete the truth tables for the two gates.



(b) The Fig. is part of a circuit used to turn on the parking lights of a car automatically when it is dark. Switch S is included so that when it is open, as shown, the automatic system is turned off. LDR is a light dependent resistor.



The truth table for this circuit is shown below. One row has been completed for you.

column 1		column 2		column 3	column 4
LDR	logic level at P	switch	logic level at Q	parking light ON/OFF	logic level at X
light	1	open	0	OFF	0
light		closed			
dark		open			
dark		closed			

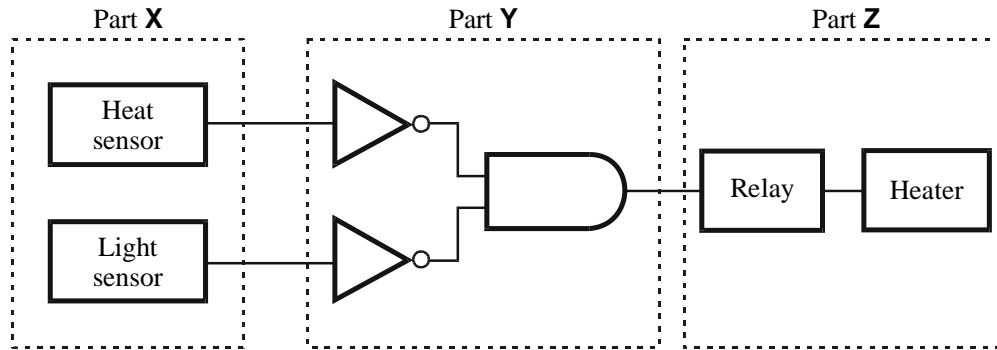
- (i) Complete columns 1 and 2 to show the logic levels at P and Q.
- (ii) Complete column 3 to show when the parking light should be ON or OFF.
- (iii) Complete column 4 to show the corresponding logic levels at X.

(iv) Complete the following statement by inserting 0 or 1 where appropriate:

The lamp must be ON when the input P is..... **and** the input Q is .....

- (v) **On the Fig. above**, show an AND and a NOT gate connected between points P, Q and X to complete the circuit correctly.

- 2 The diagram below is a block diagram of an electronic circuit. The parts of the circuit are labelled X, Y and Z.



- (a) Name the **two** types of logic gate used in the circuit above.
1. ....
  2. ....
- (b) Give an electrical device which could be used as:
- (i) the heat sensor. ....
  - (ii) the light sensor. ....
- (c) Which part of the circuit, X, Y or Z, is:
- the processor? .....
- the input device(s)? .....
- the output device(s)? .....
- (d) The heat sensor is ON when it is hot and OFF when it is cold. The light sensor is ON when it is light and OFF when it is dark.
- (i) Explain what happens in each part of the circuit when it is **both** cold and dark.
 

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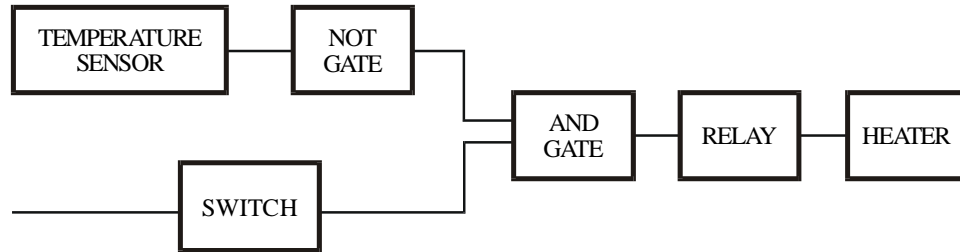
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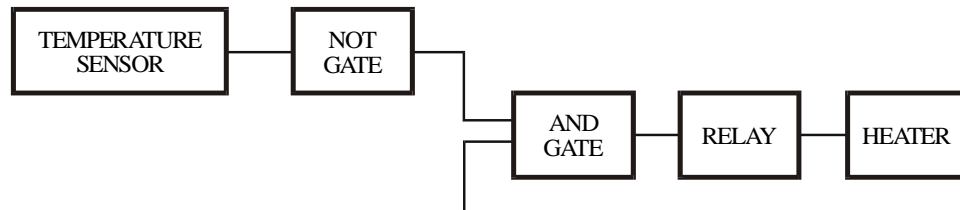
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  - (ii) Describe a practical use for the circuit.
 

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- 3 (a) The diagram below shows a logic circuit designed to switch on a heater when the temperature drops below a certain level.



Complete the logic circuit below so that the heater will only come on at night.



- (b) A firm wishes to have their safe protected by an alarm at night. It must be possible to switch the alarm on and off. When on the alarm should ring if the safe door opens and it is dark.

- (i) What input sensors should be used?

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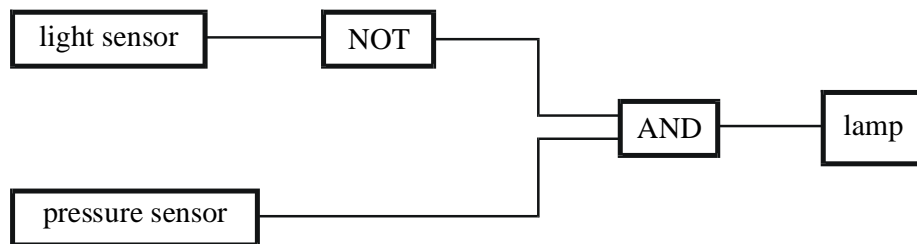
- (ii) Draw a circuit block diagram for an electronics system which would operate the alarm under the conditions specified by the firm.

- 4 (a) Complete the truth tables below.

NOT		AND			OR		
INPUT	OUTPUT	INPUT 1	INPUT 2	OUTPUT	INPUT 1	INPUT 2	OUTPUT
0		0	0		0	0	
1		0	1		0	1	
		1	0		1	0	
		1	1		1	1	

- (b) A lamp outside a front door comes on automatically when it is dark and someone stands on the doormat outside the front door.  
 A pressure sensor under the mat changes from **OFF** (0) to **ON** (1) when someone stands on the doormat.  
 The light sensor is **ON** (1) when it is light and **OFF** (0) when it is dark.

The block diagram of the circuit is shown below.



When the system was first set up, light from the lamp could shine onto the light sensor. What would happen when someone stood on the doormat when it was dark? Explain your answer.

What would happen .....

.....

Explanation .....

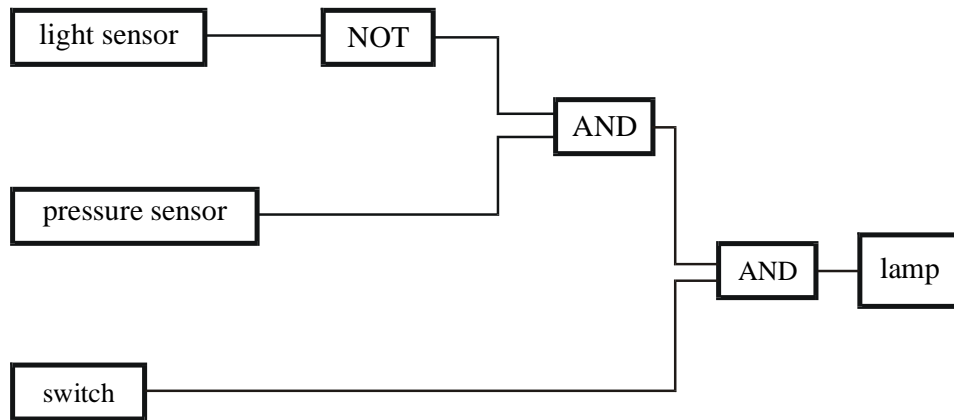
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(c) A switch is to be added to the circuit. The diagrams below show two ways of doing this.

(i)



Explain what the switch does in this circuit.

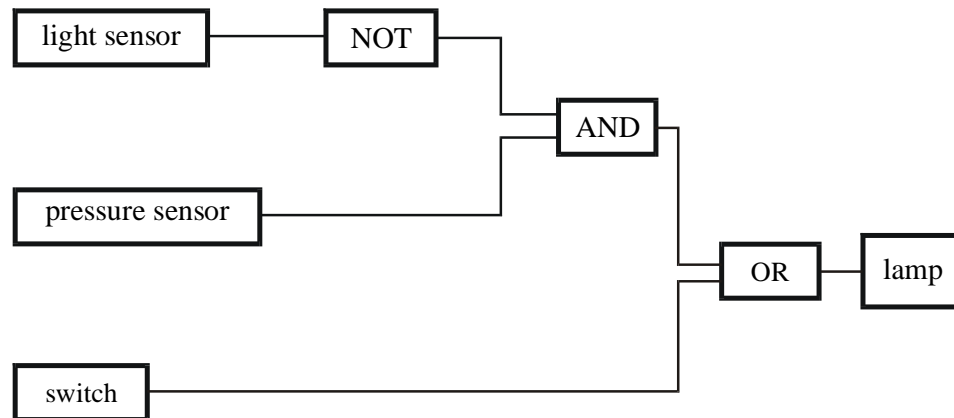
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(ii)



Explain what the switch does in this circuit.

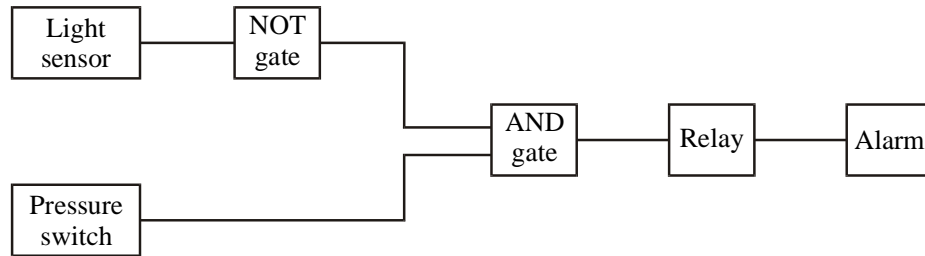
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- 5 This is a block diagram for an electronic system which switches on a security alarm if a burglar approaches a safe at night.



(a) Name

- (i) the input sensors .....
- (ii) the parts of the processor .....
- (iii) the output device .....

(b) Complete the truth tables for the NOT and AND gates used in the circuit above.

NOT	
Input	Output
0	
1	

AND		
Input 1	Input 2	Output
0	0	
0	1	
1	0	
1	1	

(c) Describe, as fully as you can, what the system does.

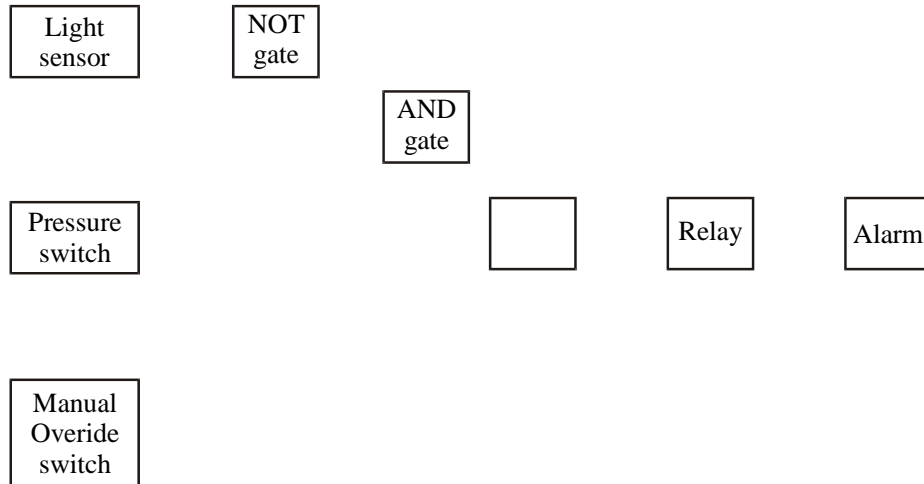
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- (d) Complete the diagram below to show how the manual override switch and an additional gate can be used to switch the system on and off.



- 6 (a) The following is a list of devices which may be used in electrical circuits.

capacitor	diode	microphone	multimeter	transistor
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Using each device only once, name the device which

- (i) allows current to flow in one direction only;

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- (ii) can store charge;

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- (iii) can act as an electronic switch;

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- (iv) can be used to measure voltage;

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- (v) can act as a sound sensor.

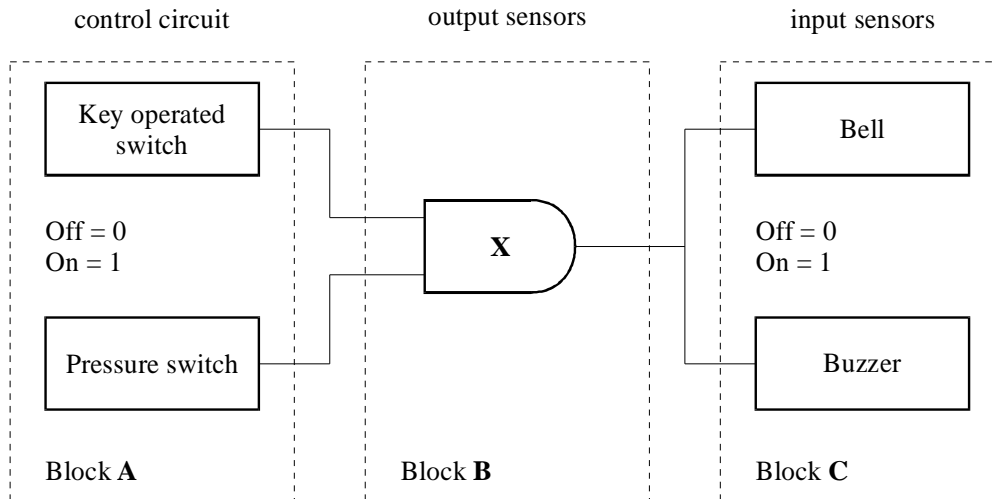
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- (b) The diagram shows a simple electronic bicycle alarm system.

There are two switches in the system:

- a key operated switch which the rider turns on when the bicycle is parked;
- a pressure switch fitted in the saddle.

- (i) The alarm system consists of three blocks, **A**, **B** and **C**. Use the following words to label each block.



.....

.....

- (ii) What sort of logic gate is gate **X**?

.....

- (iii) Complete the truth table for the system.

Key operated switch	Pressure switch	Buzzer	Bell
1	1		
1	0		
0	1		
0	0		

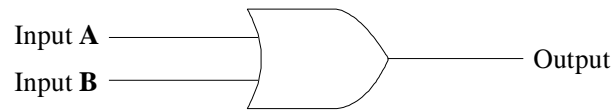
- (iv) What conditions will cause the alarm to go off?

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- 7 (a) The diagram shows the symbol for one type of logic gate.



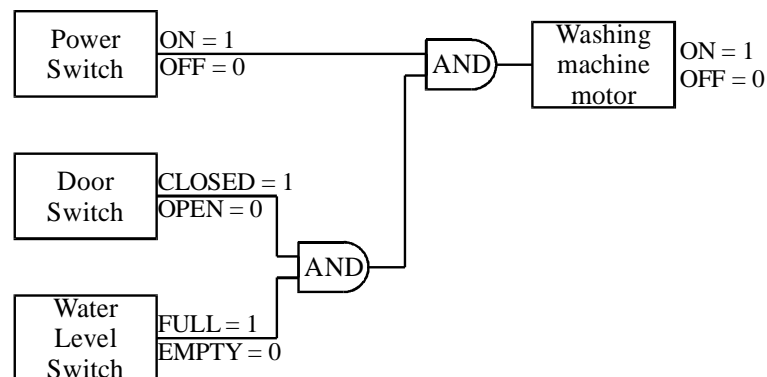
- (i) What is this type of logic gate?

.....

- (ii) Complete the truth table for this logic gate.

Input A	Input B	Output
0	0	
1	0	
0	1	
1	1	

- (b) The diagram shows a *control system* which may be fitted in an automatic washing machine.



- (i) Which part of the system forms the *control circuit*?

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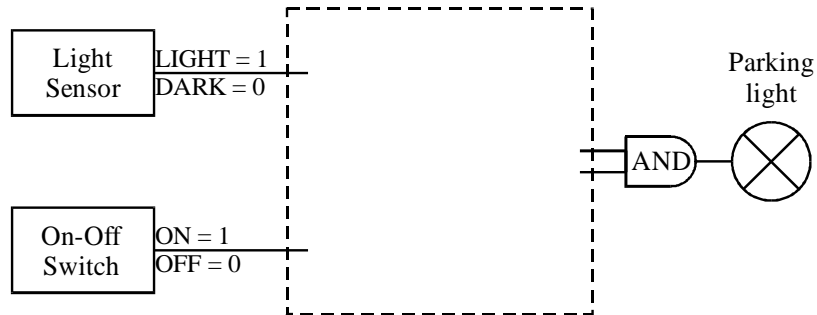
- (ii) What conditions will stop the washing machine working?

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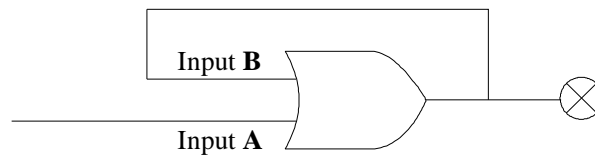
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- (c) A car may be fitted with an automatic parking light which switches on when the car is parked at night. The diagram shows an incomplete system for a parking light.



Complete the diagram to show how a NOT gate can be used to make the parking light work. Use the correct symbol for a NOT gate.

- 8 (a) The diagram shows part of a control circuit.



At first both Input **A** and Input **B** are low (0), and the lamp is off.

- (i) If the Input **A** is now made high (1), the lamp comes on. Why?

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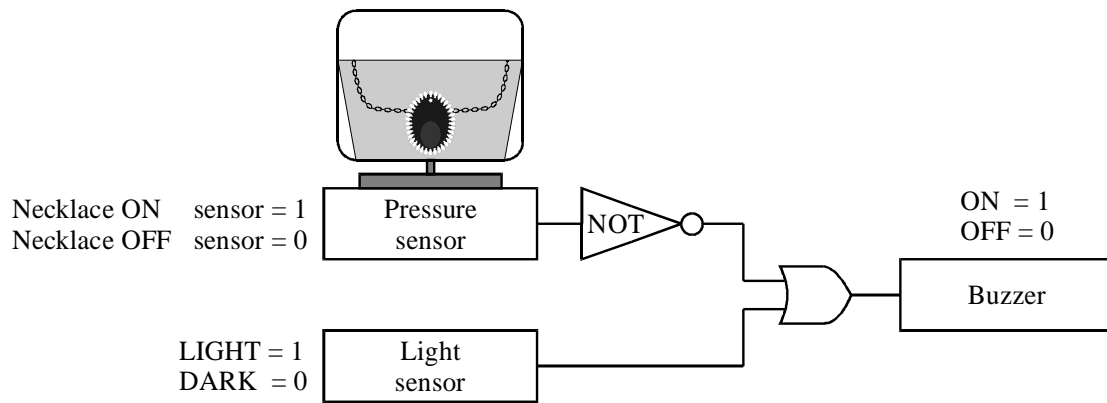
- (ii) If Input **A** is now made low (0), the lamp stays on. Explain why.

.....  
 .....

- (iii) The circuit includes a feedback loop. What effect does negative feedback have on a control system?

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 .....

- 9 (a) The diagram shows part of a simple alarm system used to protect a valuable necklace.



- (i) Complete the truth table for the NOT gate.

INPUT	OUTPUT
1	
0	

- (ii) Complete the truth table for the alarm system.

Pressure sensor	Light sensor	Buzzer
0	0	
0	1	
1	0	
1	1	

- (iii) Explain how this alarm system would work.

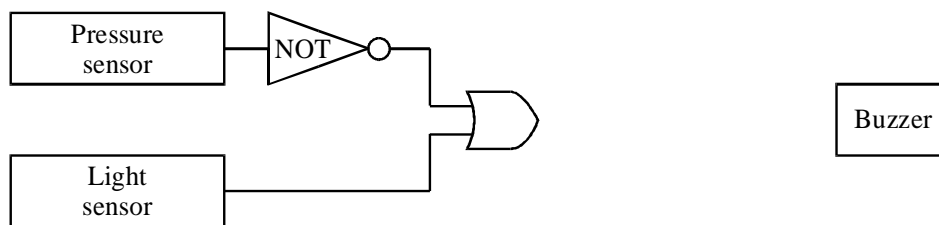
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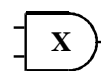
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- (b) The alarm needs to be able to be switched on and off. To do this a key operated switch and a logic gate **X** are added to the circuit.



ON = 1  
OFF = 0

Key-operated  
switch

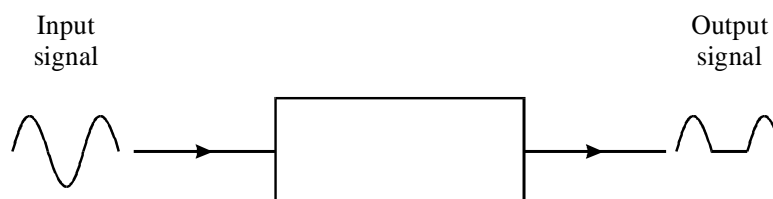


- (i) What type of logic gate is **X**?

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- (ii) Complete the circuit above to show how the keyoperated switch and logic gate **X** should be connected into the alarm system.

- 10 (a) The diagram shows an input signal going to a box and the output signal which leaves the box.



Which **one** of the following components could be inside the box. Underline your answer.

capacitor

diode

resistor

transistor

- (b) The names of four electrical devices are given on the left. What each device does is given on the right. Draw lines to join each device to what it does.

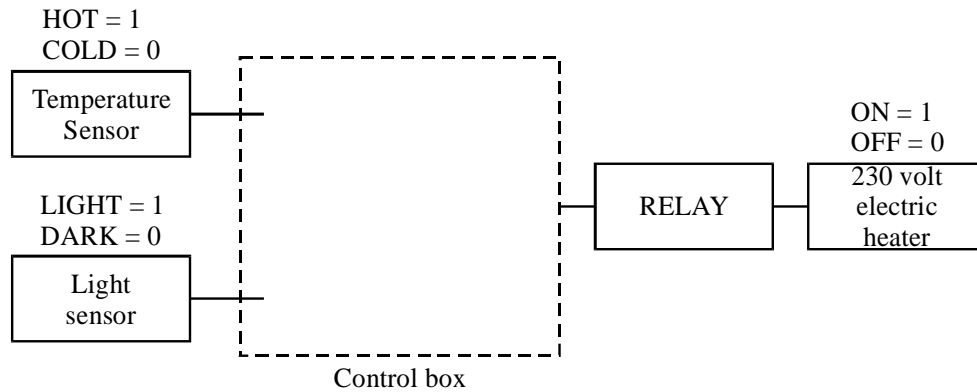
Device	What the device does
LED	measures current, voltage or resistance
loudspeaker	emits light to indicate current flow
multimeter	produces an output sound
microphone	transfers sound energy to electrical energy

- (c) In the sentence below, cross out the **two** words in the box that are wrong.

A cathode ray oscilloscope measures

current.  
resistance.  
voltage.

- 11 (a) The diagram shows part of a heating system. It is designed to switch on automatically when it is both cold and dark. The control box contains two logic gates which are not shown.



- (i) What is the name and circuit symbol for an input sensor which responds to light?

Name: .....

Circuit symbol:

- (ii) What is the name and circuit symbol for an input sensor which responds to temperature?

Name: .....

Circuit symbol:

- (iii) Complete the truth table for the control system.

Light sensor	Temperature sensor	Heater
1	1	
1	0	
0	1	
0	0	

- (iv) Underline the names of the **two** logic gates that should be used inside the control box.

AND      NOT      OR

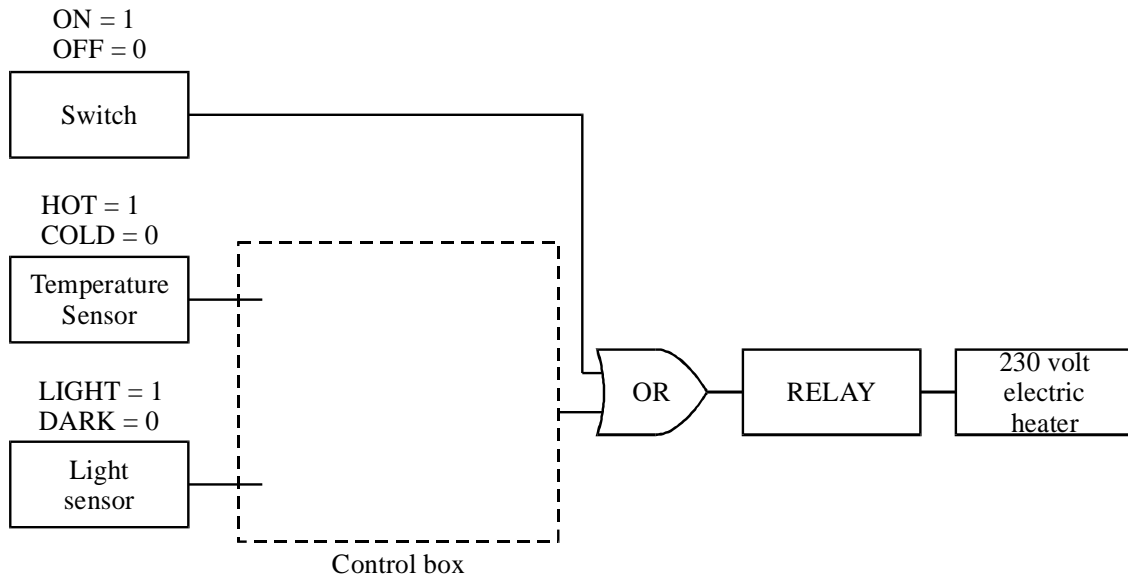
- (v) Complete the diagram in part (a) above to show how the two logic gates are used to connect the input sensors to the relay. Use the correct symbols for the logic gates.

(vi) Why must a relay be used to operate the heater?

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(b) The diagram shows an additional logic gate and switch added to the system.



Explain how this change allows the heater to be switched on at any time. The explanation has been started for you.

*Closing the switch sends* .....

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