

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Secondary Education  
June 2005



**ELECTRONICS  
FOUNDATION TIER**

**3432/F**

Thursday 26 May 2005 9.00 am to 10.30 am

**F**

<p><b>In addition to this paper you will require:</b></p> <ul style="list-style-type: none"> <li>• a pencil and a ruler;</li> <li>• a calculator.</li> </ul>
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Time allowed: 1 hour 30 minutes

**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Show the working of your calculations.

**Information**

- The maximum mark for this paper is 120.
- Mark allocations are shown in brackets.
- A list of formulae and other information, which you may wish to use in your answers, is provided on page 2.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
9			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

# Information Sheet

The following information may be useful in answering the questions.

1. **Power**

Power = voltage x current;  $P = VI$

2. **Amplifiers**

Voltage gain  $G_v = \frac{V_{out}}{V_{in}}$

3. **Resistor colour code**

The colours in the resistor colour code correspond to the following values.

BLACK	0	GREEN	5
BROWN	1	BLUE	6
RED	2	VIOLET	7
ORANGE	3	GREY	8
YELLOW	4	WHITE	9

The fourth band colour gives the tolerance.

GOLD  $\pm 5\%$

SILVER  $\pm 10\%$

No fourth band  $\pm 20\%$

4. **Resistor printed code (BS 1852)**

R means x 1

K means x 1000

M means x 1 000 000

Position of letter gives the decimal point.

Tolerances are indicated by adding a letter at the end.

J  $\pm 5\%$

K  $\pm 10\%$

M  $\pm 20\%$

e.g. 5K6J = 5.6 k $\Omega$   $\pm 5\%$

5. **Preferred values for resistors (E24 SERIES)**

1.0 1.1 1.2 1.3 1.5 1.6 1.8 2.0 2.2 2.4 2.7 3.0 3.3 3.6 3.9 4.3 4.7 5.1 5.6 6.2 6.8 7.5 8.2 9.1  
and multiples of ten.

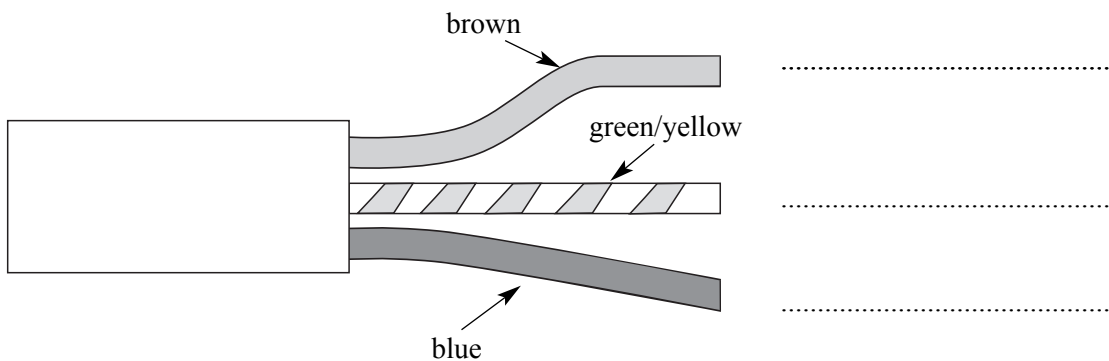
6. Resistance =  $\frac{\text{voltage}}{\text{current}}$ ;  $R = \frac{V}{I}$

7. Effective resistance, R, of resistors in series is given by

$$R = R_1 + R_2 + R_3.$$

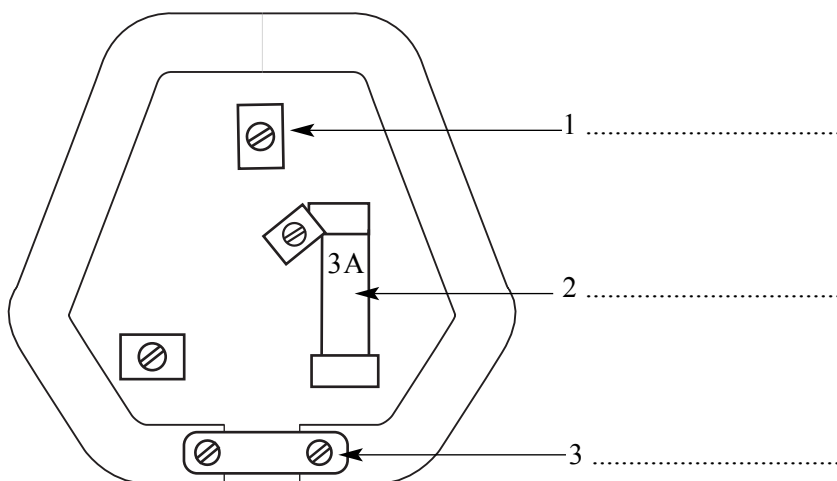
Answer **all** questions in the spaces provided.

- 1 (a) A section of mains cable is shown below with the colours of the wires indicated next to them. Label each wire with its correct name.



(3 marks)

- (b) (i) The cable is to be fitted to a mains plug, shown below. Label the three parts of the plug indicated.



- (ii) Explain the function that each part, indicated on the diagram above, has for electrical safety.

1 .....

.....

2 .....

.....

3 .....

.....

(7 marks)

Turn over ▶

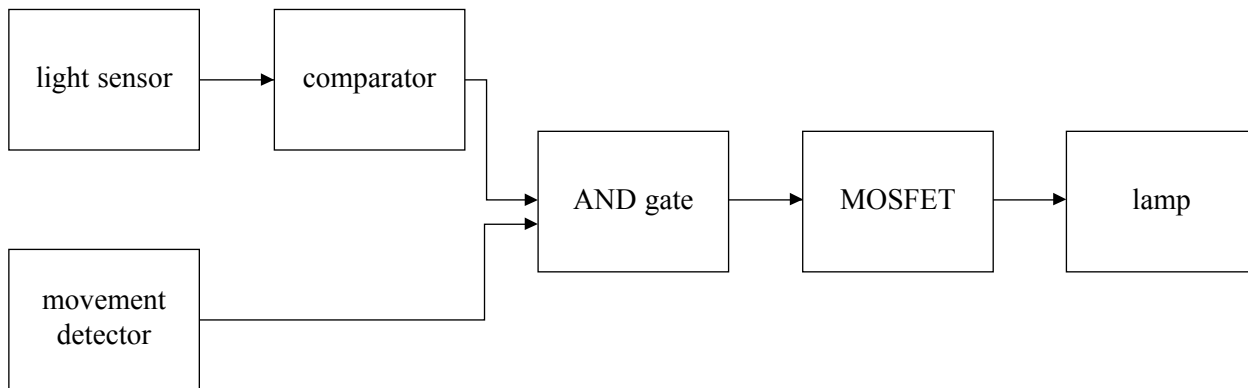
2 Draw circuit symbols for the components named below.

Component	Circuit symbol
Resistor	
Capacitor	
Diode	
LED	
LDR	
Lamp	
Variable resistor	
Loudspeaker	
Battery	
Switch	

(10 marks)

10

3 The system shown below will turn on a lamp if it is dark and movement is detected.



(a) Which of the blocks represent:

- (i) inputs; 1 ..... 2 .....
- (ii) an output; .....
- (iii) an analogue to digital converter? .....

(4 marks)

(b) In which block could:

- (i) a logic IC be found; .....
- (ii) an op-amp IC be found; .....
- (iii) an LDR be found? .....

(3 marks)

(c) Which block uses a voltage to control a large current? ..... (1 mark)

(d) The system is to be changed so that the lamp stays on for 30 s each time.

- (i) What extra block is needed?  
.....
- (ii) Where in this system could this extra block be placed?  
.....

(2 marks)

- 4 (a) (i) Draw the logic symbol for a NOR gate in the space below. Label its inputs A and B and its output Q.

- (ii) Complete the truth table for the NOR gate.

A	B	Q
0	0	
0	1	
1	0	
1	1	

(7 marks)

- (b) Another logic gate has the following truth table.

A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

- (i) Name this type of logic gate .....
- (ii) Draw and label the symbol for this type of logic gate, using the letters from the table above.

(3 marks)

5 State the name and the parameters for each of the components shown below.

(a)



Component name .....

Value .....

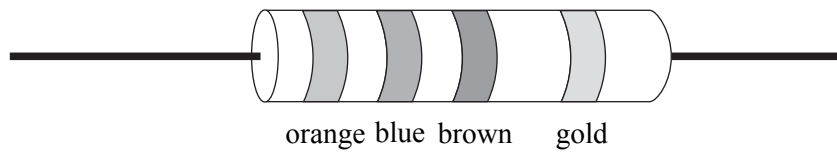
Maximum working voltage .....

What else is indicated on the component casing?

.....

(4 marks)

(b)



Component name .....

Value .....

Tolerance .....

What is a function of this component in a circuit?

.....

(6 marks)

- 6 (a) Label the block diagram of a simple radio receiver using the following terms:

**aerial**      **af amplifier**      **demodulator**      **loudspeaker**      **rf tuned circuit**



(5 marks)

- (b) A student modifies the radio system so that a microphone can be connected to the af amplifier.

The microphone used gives an output of 10 mV (0.01 V) at low current. A  $4\ \Omega$  loudspeaker is used that gives the required sound level when a 2 V signal is fed to it.

- (i) Calculate the required voltage gain of the audio amplifier IC.

.....

- (ii) What other type of gain is needed in the audio amplifier IC?

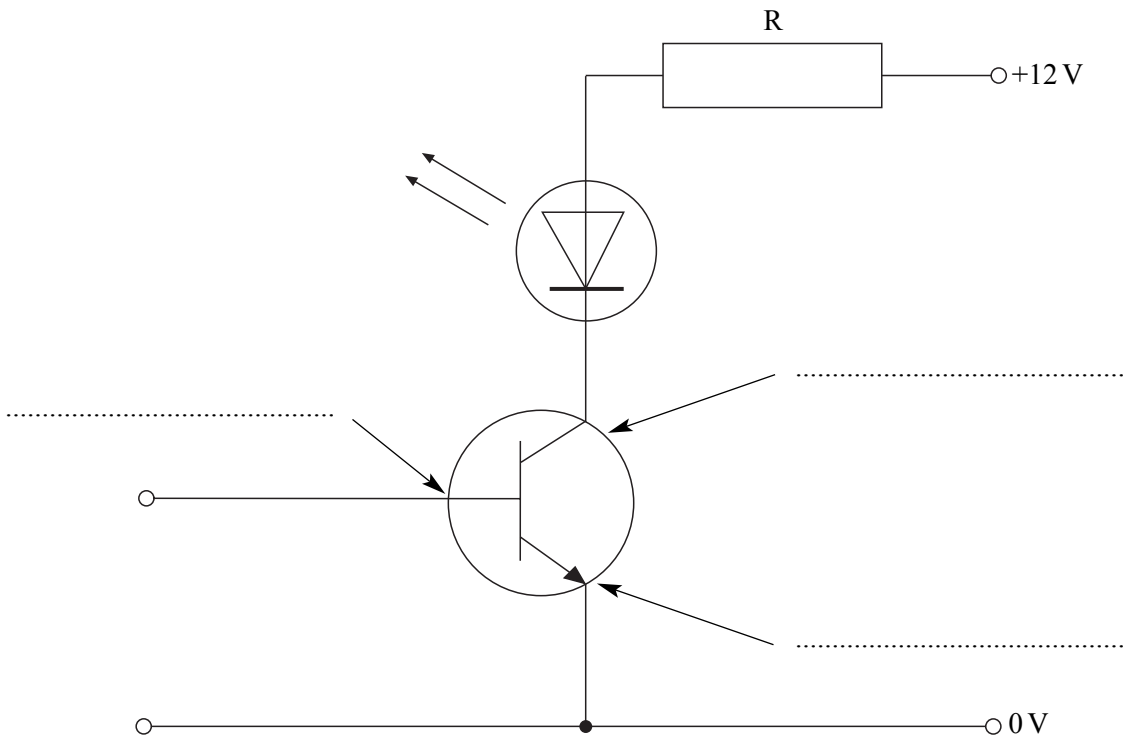
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- (iii) Draw a diagram of the modified system including its battery power supply.

(5 marks)



7 An npn silicon transistor is used to control a LED in the circuit shown below.



(a) Label the three leads of the transistor. (3 marks)

(b) The LED has a forward voltage of 2 V when conducting a current of 25 mA. The transistor has 0.5 V across the collector and emitter terminals when switched on.

(i) Calculate the voltage across resistor, R, under these conditions.

.....

(ii) Calculate the required resistance of R.

.....

(iii) Which preferred value should be used for R if the 25 mA LED current is **not** to be exceeded?

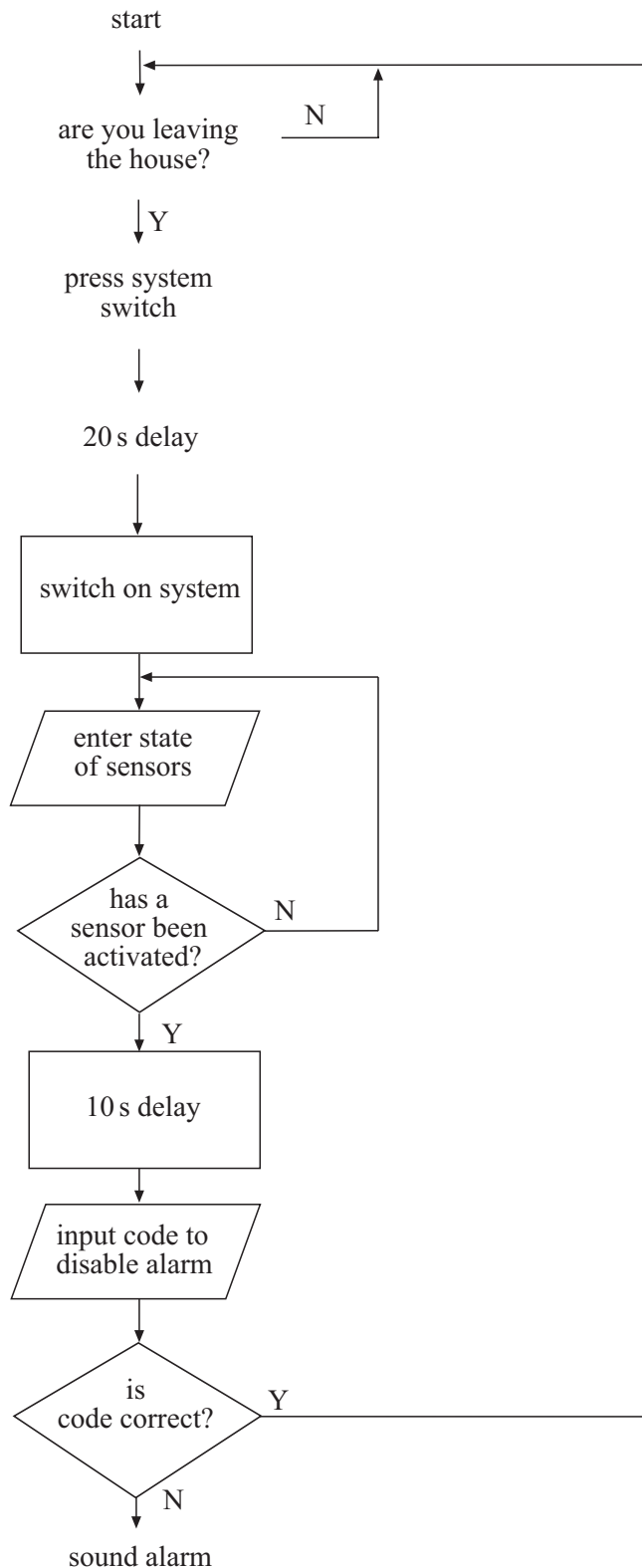
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(iv) Calculate the power dissipated by the resistor when the LED is on.

.....

(7 marks)

8 The flowchart describes the operation of a simple house intruder alarm. Some of the flowchart symbols have been left out.



(a) Draw the correct flowchart symbols at **five** places where they are missing on the diagram. (5 marks)

(b) Label on the flowchart:

**a decision box**  
**an output box**

**an input box**  
**a process box**

**a loop**

(5 marks)

- (c) An intruder, who does not know the correct code in order to disable the alarm, enters the house after the alarm has been set.

Using the flowchart in part (a), describe the sequence of events that will occur.

.....

.....

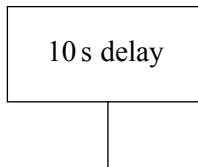
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(5 marks)

- (d) Using the lower part of the flowchart in part (a) as a guide, draw a new flowchart that would allow two incorrect attempts at entering the code before sounding the alarm when a third incorrect attempt is made. Start your flowchart from the 10 s delay box.



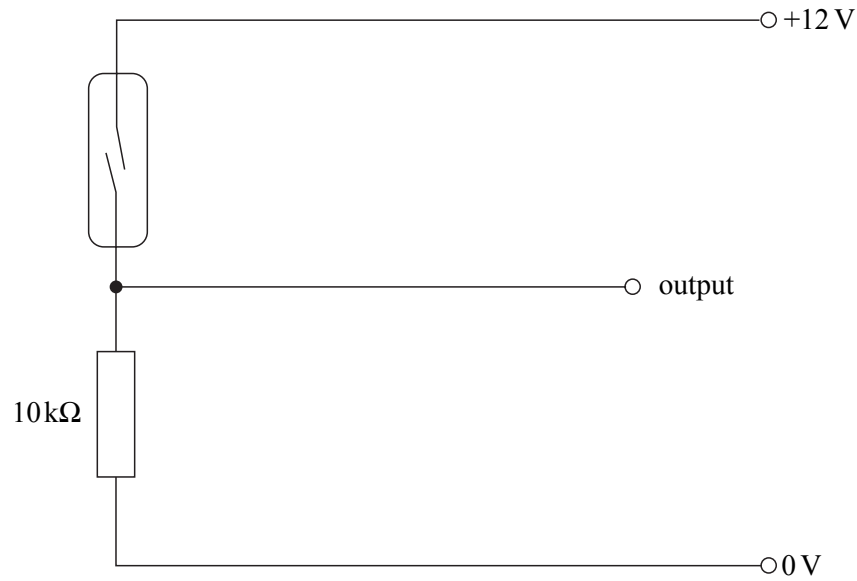
(5 marks)

9 A student designs a simple house intruder alarm system. One input to the system is a reed switch on the front door. When the front door is opened a 10 s timer starts. The person entering has to input a code number on a keypad connected to a logic gate to disable the system during these 10 s. If the correct code number is not entered a second timer is triggered which operates an audible warning device.

(a) Draw a system diagram for this alarm system.

(6 marks)

(b) The reed switch input circuit is shown below.



A magnet on the door keeps the reed switch closed when the door is shut. The reed switch contacts open when the door opens.

(i) State the output voltage when:

the door is shut; .....

the door is opened. ....

(ii) Calculate the current flowing through the circuit when the door is shut.

.....

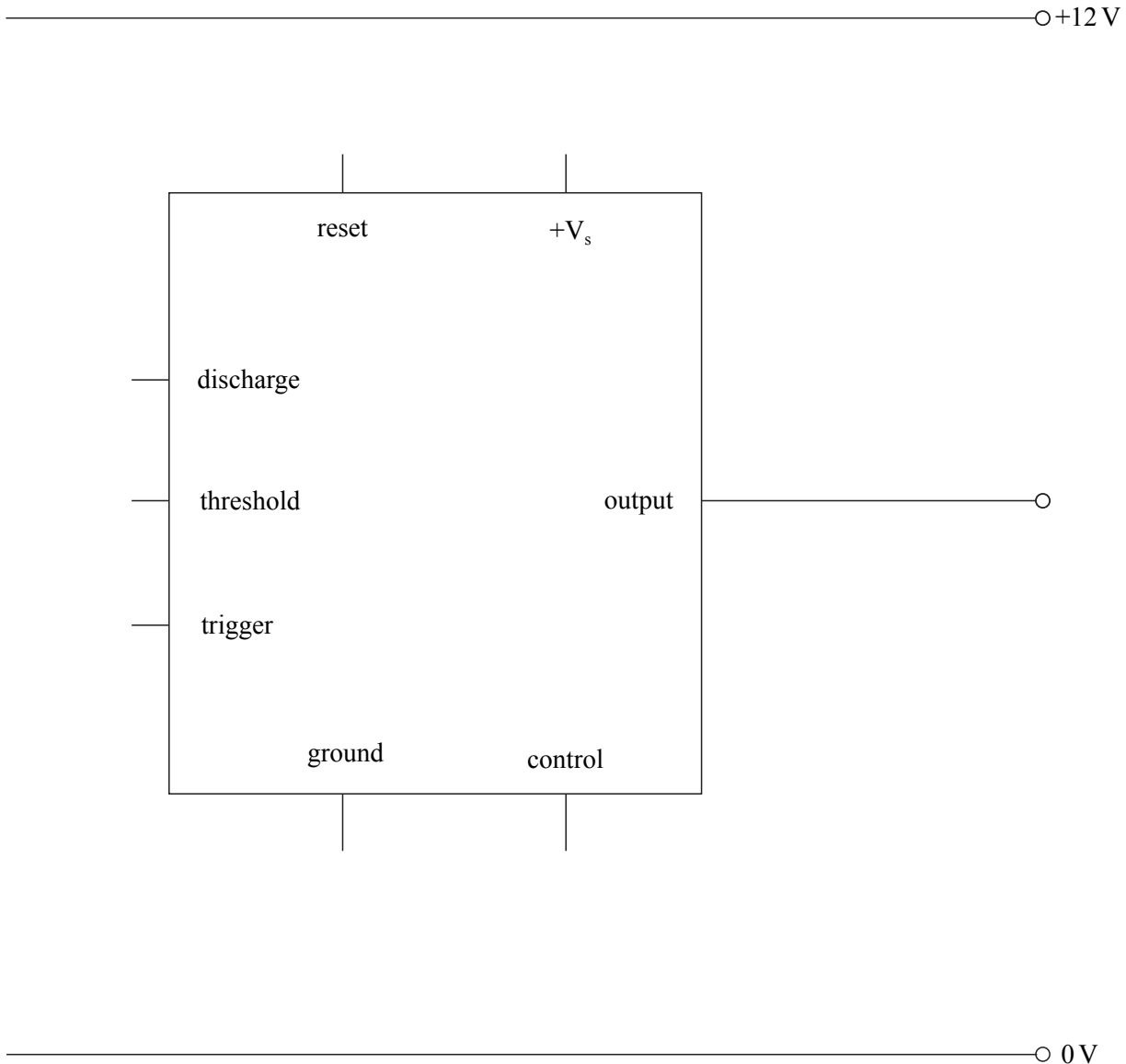
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(4 marks)

**QUESTION 9 CONTINUES ON THE NEXT PAGE**

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- (c) Complete the circuit diagram below to show how a 555 IC would be connected to form the 10 s timer. Include all components and label the input.



(8 marks)

- (d) (i) Explain how the 10 s timer is triggered by the door opening. Include in your answer reference to voltage levels produced by the input circuit and those required by the monostable in its operation.

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.....

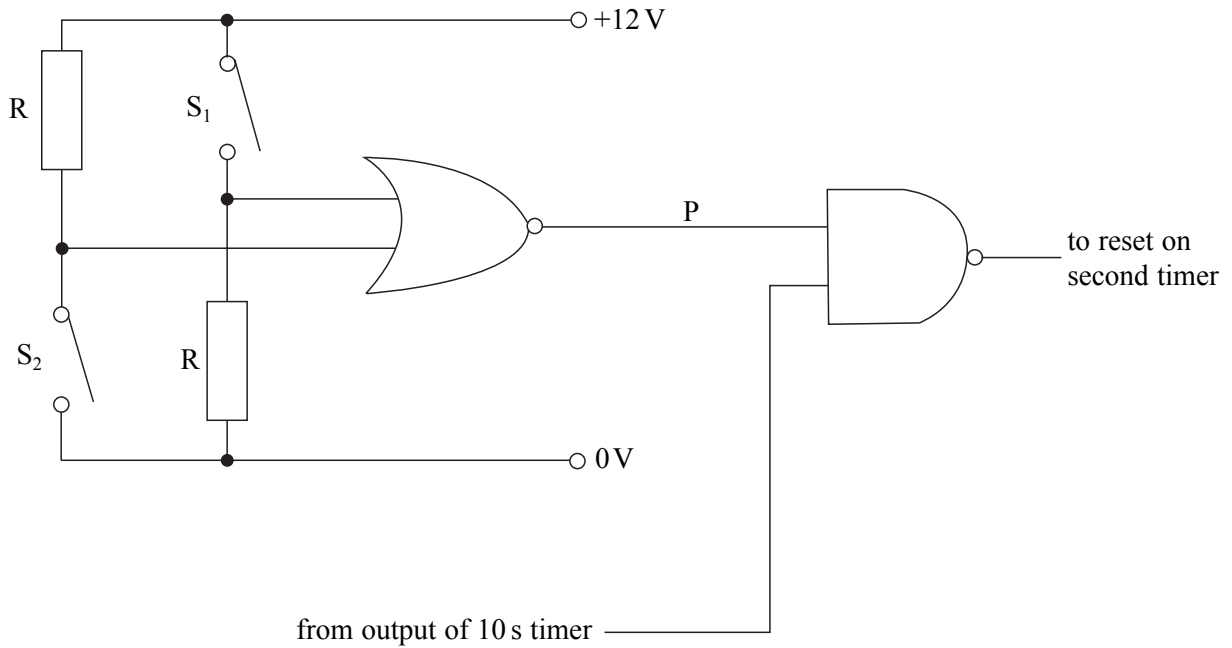
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- (ii) The second timer also uses a 555 IC and has a logic system connected to its reset input. What voltage level will:

1. stop the timer operating; .....
2. allow the timer to function? .....

(6 marks)

(e) The switches and logic gate circuit are shown below.



(i) Both switches  $S_1$  and  $S_2$  are shown open. State the condition of each switch required to give a logic 1 at P.

$S_1$  .....

$S_2$  .....

(ii) If the switches are set correctly in the first 10 s after entering the house, what logic level is sent to the second timer reset pin?

Logic level .....

(iii) Explain why the second timer can only be reset during the first 10 s after entering the house. Make reference to the type of gate that is connected to the second timer reset pin.

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

(6 marks)

END OF QUESTIONS

**THERE ARE NO QUESTIONS PRINTED ON THIS PAGE**