National 4
Physics

KU Revision Questions for Electricity & Energy Unit Assessment

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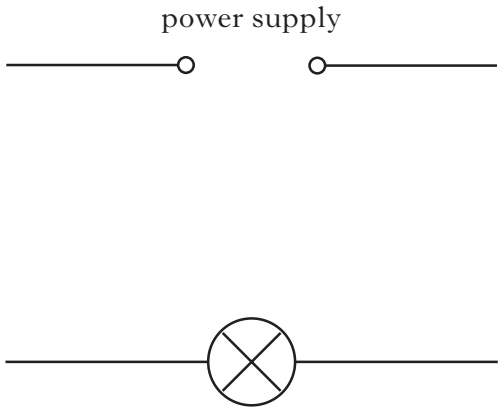
Marks

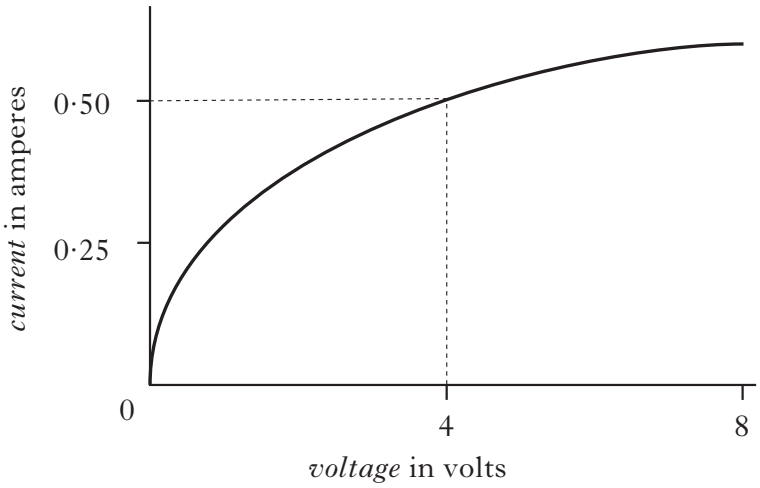
25. A power supply, an ammeter and a voltmeter are used to investigate how the current in a lamp changes as the voltage across the lamp changes.

(*a*) Complete the circuit diagram, including the voltmeter and ammeter, to show how the voltage and current are measured.



3

(*b*) The graph shows the results of the investigation.



Calculate the resistance of the lamp when the voltage across it is 4 volts.

2

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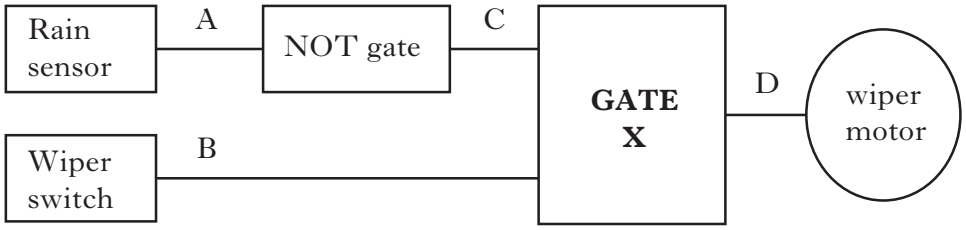
30. Some cars have "smart windscreen wipers" that operate whenever rain lands on the car windscreen.

An electronic system diagram for the "smart wipers" is shown.



The wiper switch must be on for the "smart wipers" to work.

The sensor outputs logic 1 when there is no rain and logic 0 when rain lands on the windscreen.

(*a*) Draw the circuit symbol for a NOT gate

1

(*b*) Identify Gate X

1

(*c*) Complete the table to show the logic levels at C and D.

A	**B**	**C**	**D**
0	0		
0	1		
1	0		
1	1		

2

DO NOT WRITE IN THIS MARGIN

Marks

29. (*a*) An electronic system consists of three parts.
Complete the block diagram below.

1

(*b*) Some electronic devices are listed below.

microphone	**motor**	**switch**
loudspeaker	**lamp**	**LED**

(i) Complete the table below by putting each device in the correct column.

Input device	*Output device*

3

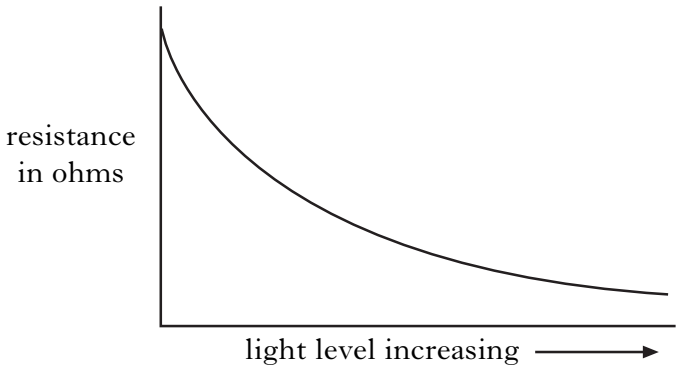
(ii) What is the energy change in an LED?

1

Marks

29. (continued)

(*c*) The resistance of an LDR is measured as the light level increases. The results are shown on a graph.



(i) Looking at the graph, state what happens to the resistance of the LDR as the light level increases.

1

(ii) Name the meter used to measure resistance.

1

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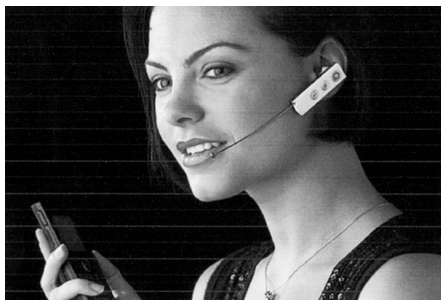
22. A "hands-free" system for a mobile phone has an earpiece and a microphone.



(*a*) State the useful energy change that takes place in the:

(i) earpiece;

1

(ii) microphone.

1

(*b*) State **one advantage** of using a mobile phone instead of a landline.

1

(*c*) Give **one** reason why it is difficult for a mobile phone to pick up signals in a steep-sided valley.

1

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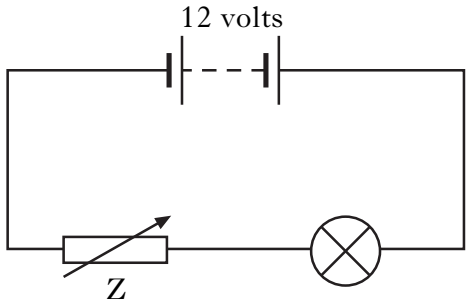
23. A student sets up the following circuit.



(*a*) What is component Z? **1**

(*b*) The student measures the voltage across the lamp with a voltmeter.

(i) Draw the symbol for a voltmeter. **1**

(ii) Add your symbol to the circuit diagram above to show the voltmeter measuring the voltage across the lamp. **1**

(iii) The voltage across the lamp is 7 volts.

What is the voltage across component Z?

1

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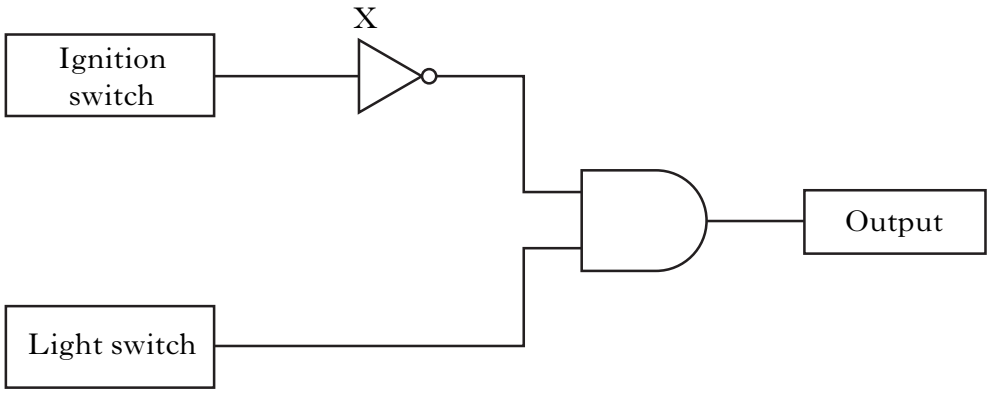
31. In a car, a warning sounds if the lights are left on after the ignition switch is turned off. The system has two inputs, one from the ignition switch and the other from the light switch.



(*a*) Name logic gate X. **1**

(*b*) Complete the logic table for gate X.

Logic level from ignition switch	*Output logic level from the gate*
0	
1	

1

(*c*) Some electronic devices are listed below.

microphone buzzer LDR thermistor motor

Select an appropriate output device for this system.

1

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Marks

31. (continued)

(*d*) Explain why the output device is **on** when the ignition switch is **off** but the lights are **on**.

2

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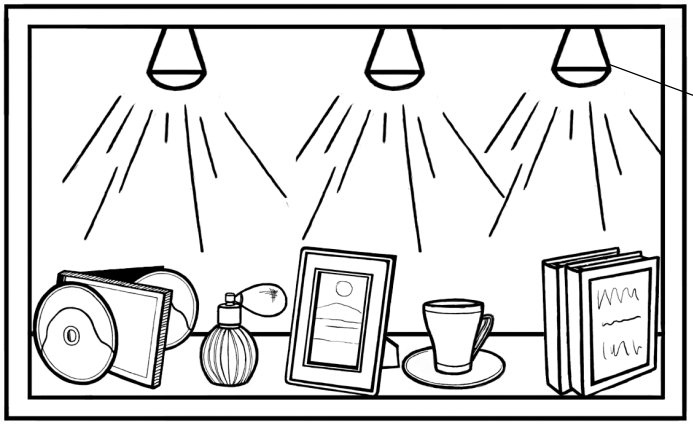
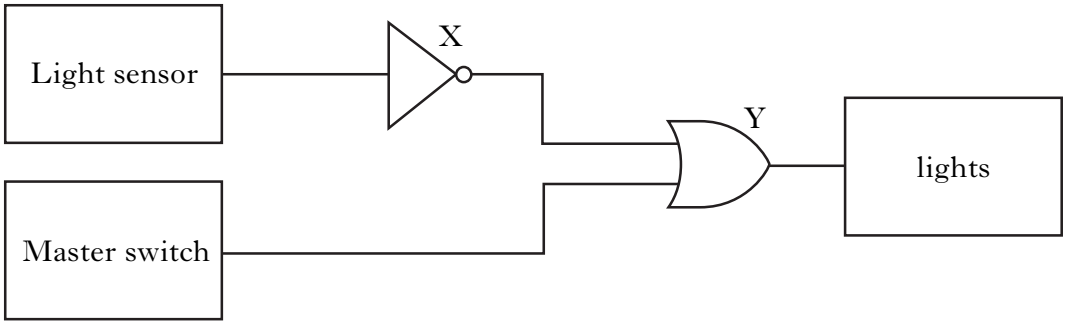
33. Lights in a shop window are connected to an electronic system which switches them on when it becomes dark. The lights can also be switched on by a master switch.



(*a*) A diagram for the electronic system is shown below.



Light sensor in darkness gives a logic 0.
Light sensor in light gives a logic 1.

(i) Name logic gate X.

1

(ii) Explain the function of logic gate X.

2

(iii) Name logic gate Y.

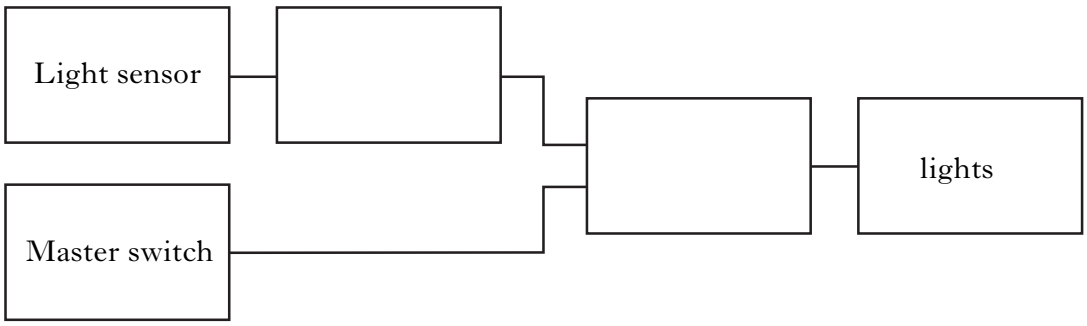
1

Marks

33. (continued)

(*b*) The shop owner buys a new electronic system which requires both darkness and the master switch to be on to make the lights come on.

Complete the diagram below by drawing in the symbols for the logic gates required for the new system.



2

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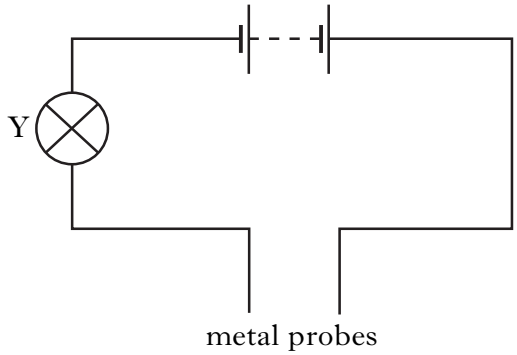
25. A student's games console stops working. She builds the circuit below to test the fuse in the plug.

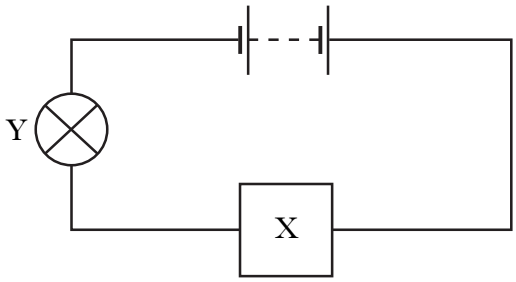


(*a*) The student touches the metal probes together and bulb Y lights.

She connects the metal probes to the fuse from the games console. This time bulb Y does not light. What might be wrong with the fuse?

1

(*b*) The student sets up a new circuit including component X.



X is used to vary the brightness of bulb Y. What is component X?

1

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Marks

25. (continued)

(*c*) The student adds an ammeter to the circuit in (*b*) to measure the current. Draw this new circuit including the ammeter and the correct symbol for component X.

2

(*d*) The voltage of the battery in the circuit is 6 volts. The ammeter shows a current of 0·1 amperes. Calculate the resistance of the circuit.

2

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33. (*a*) An electronic system can be represented by a block diagram as shown.

Complete the block diagram by filling in the missing labels.

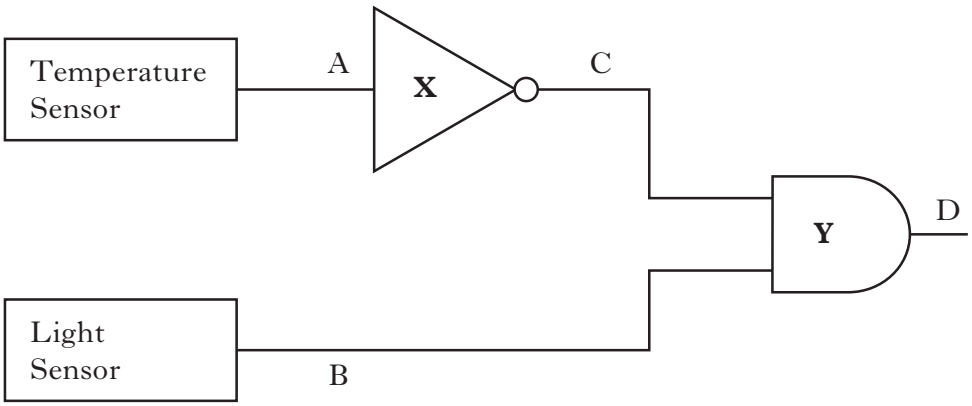
1

(*b*) A circuit is set up to open a window in a greenhouse when the daytime temperature inside becomes too warm.

The diagram shows part of the circuit.

Temperature sensor when warm gives logic 0.

Temperature sensor when cold gives logic 1.



Light sensor in darkness gives logic 0.

Light sensor in light gives logic 1.

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Marks

33. (*b*) (continued)

(i) Name logic gate **X**.

1

(ii) Name logic gate **Y**.

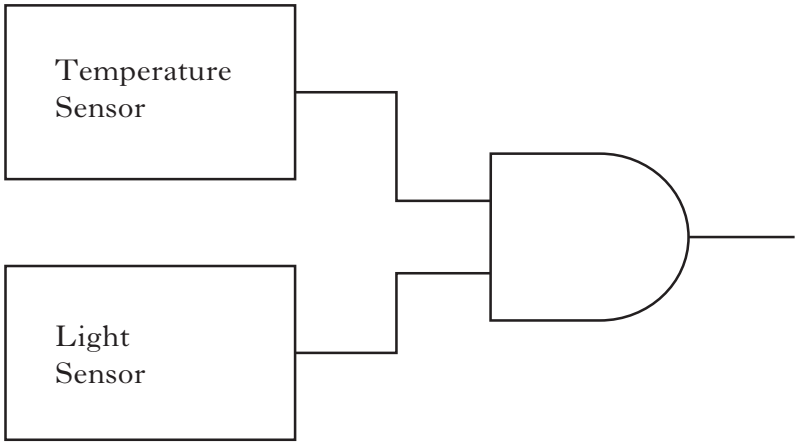
1

(*c*) Complete the table below to show the logic levels at C and D.

A	B	C	D
0	0		
0	1		
1	0		
1	1		

2

(*d*) Gate X is removed from the circuit as shown.



Describe how the circuit will now operate.

2

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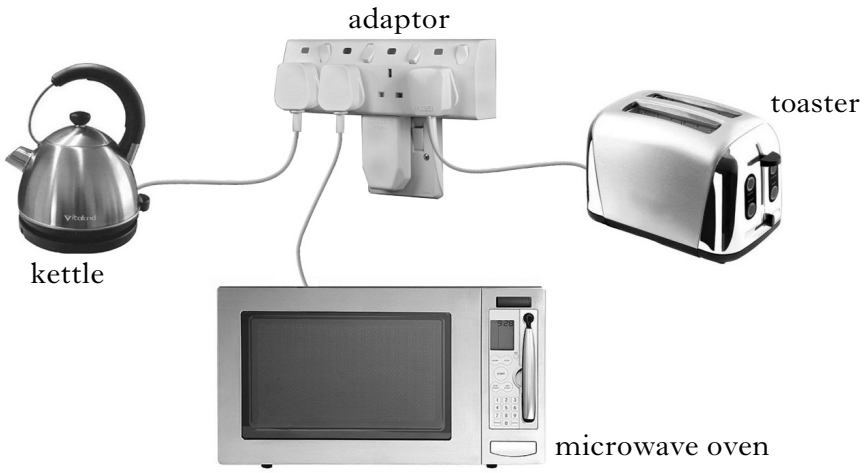
24. A student plugs a toaster, a kettle and a microwave oven into an adaptor.



The table shows information about the appliances.

Appliance	*Voltage in* volts	*Power in* watts	*Current in* amperes
Microwave oven	230	690	3
Toaster	230	1150	5
Kettle	230	2070	

(*a*) Show by calculation that the current in the kettle is 9 amperes when operating.

You **must** show your working.

2

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Marks

24. (continued)

The adaptor is fitted with a 13 ampere fuse.

(*b*) (i) Which **two** appliances must **not** be switched on at the same time?

1

(ii) Explain your answer.

1

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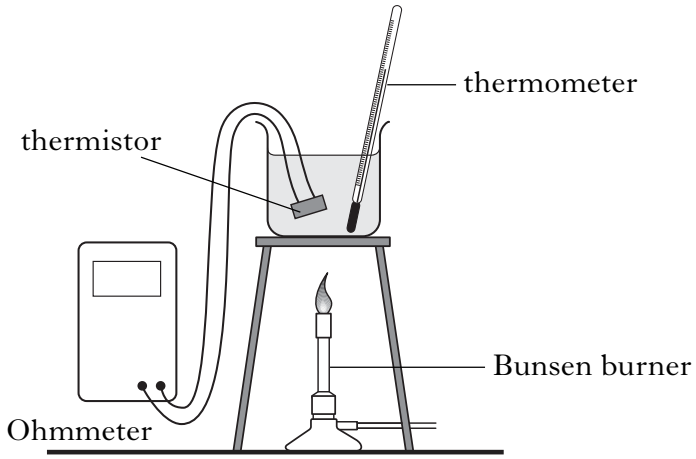
31. Washing machines use thermistors as temperature sensors.

(*a*) Is a thermistor an **input**, **process** or an **output** device?

1

(*b*) A student wants to check that a washing machine thermistor is working correctly. He sets up the following experiment.



Explain how he should use the equipment to investigate how the resistance of the thermistor is affected by temperature.

Your answer should include:

- how he used the equipment
- what he measured.

2

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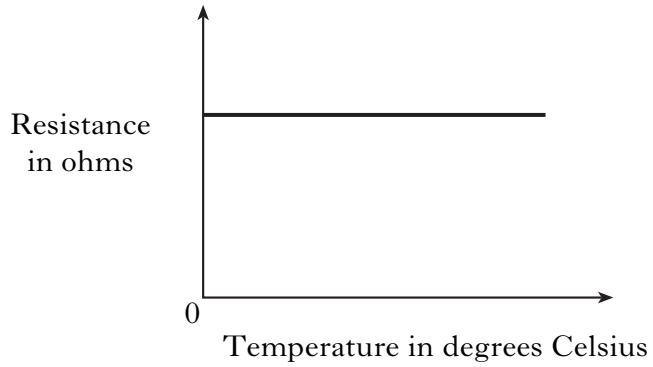
Marks

31. (continued)

(*c*) After the experiment, the student plotted the following graph.



(i) Was the thermistor working correctly?

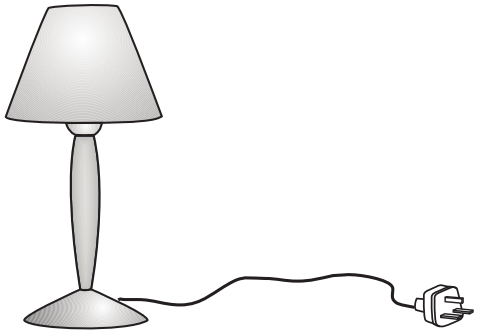
1

(ii) Explain your answer.

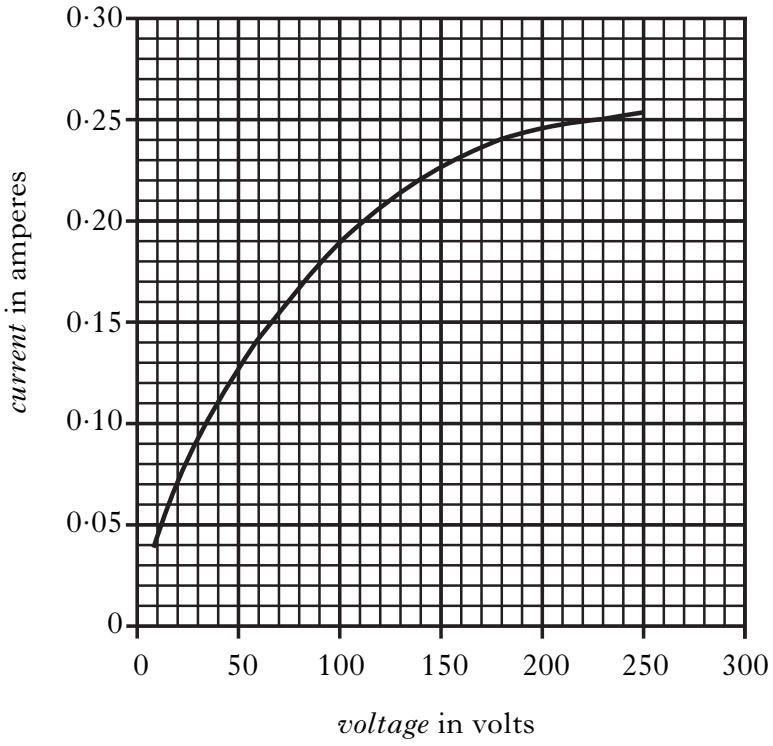
1

Marks

23. (*a*) A technician for a lamp company is investigating the properties of a lamp at different voltages.



For different voltages the technician measures the current in the lamp. The graph of her results is shown below.



(i) What is the value of mains voltage?

1

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Marks

23. (*a*) (continued)

(ii) What is the current in the lamp when it is being operated at mains voltage?

1

(iii) Calculate the resistance of the bulb at mains voltage.

2

(*b*) The bulb is now operated at a lower voltage than mains voltage.

(i) Will the resistance of the bulb be **bigger**, **smaller** or **the same as** your answer in (*a*)(iii)?

1

(ii) Explain your answer.

1

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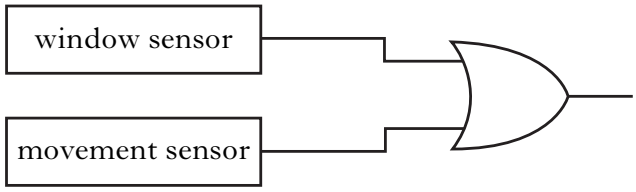
Marks

30. A car alarm system has two sensors.
One sensor activates if someone smashes a window.
The second sensor activates if someone tries to move the car.
Each sensor gives a high output when activated.

(*a*) The two sensors are connected to a logic gate as shown.



Complete the table to show the output from the logic gate.

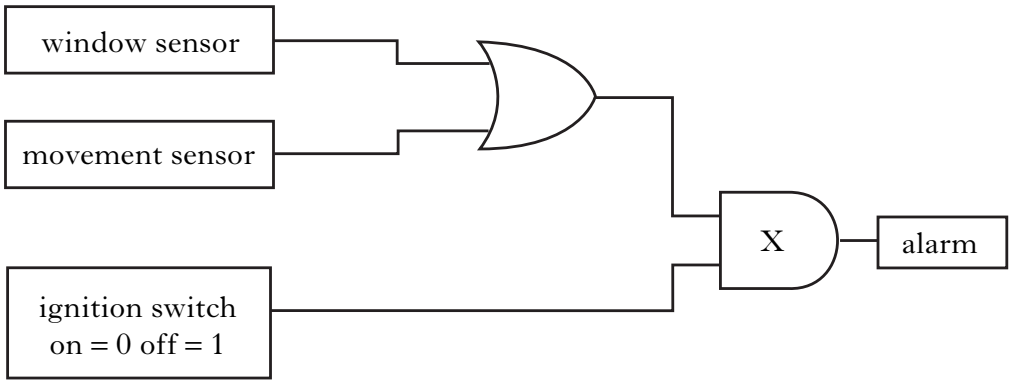
Logic level of window sensor	*Logic level of movement sensor*	*Output logic level of gate*
0	0	
0	1	
1	0	
1	1	

1

Marks

30. (continued)

(*b*) If the owner wants to drive the car, the alarm must be switched off.



(i) Name logic gate X. **1**

(ii) Is the output from the ignition switch **high** or **low** when the switch is on? **1**

(iii) Explain why the alarm will not sound if the car is moved when the ignition switch is on. **2**

DO NOT WRITE IN THIS MARGIN

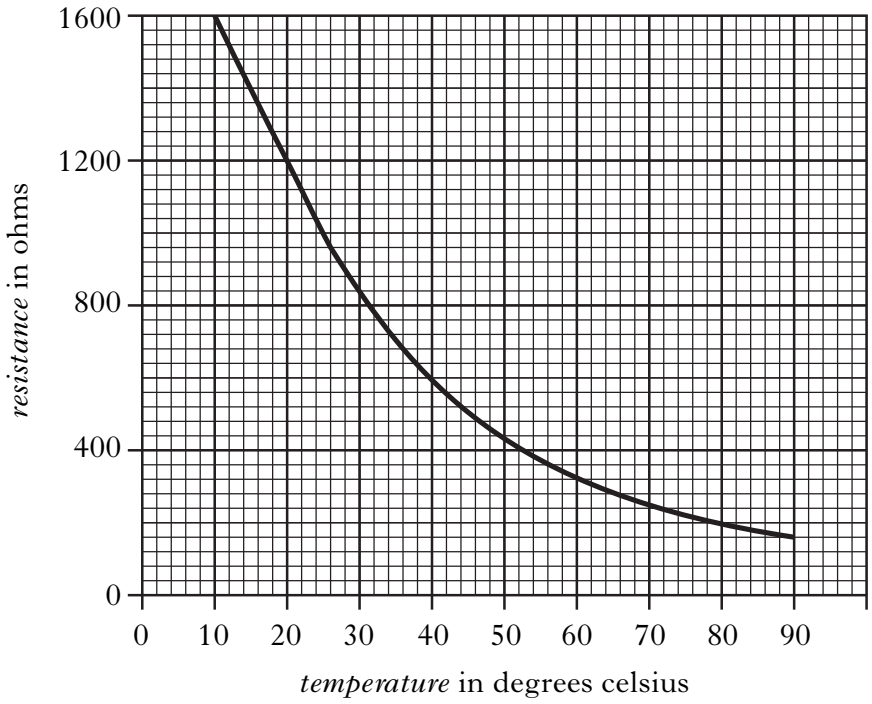
Marks

30. A student investigates the properties of a thermistor. The student places the thermistor in a water bath and measures the resistance of the thermistor as the temperature rises.

(*a*) Is the thermistor an **input**, **process** or **output** device?

1

(*b*) A graph of the student's results is shown below.



(i) What is the resistance at 20 degrees celsius? **1**

(ii) What is the resistance at 80 degrees celsius? **1**

(iii) What happens to the resistance of the thermistor as the temperature increases?

1

[Turn over