

Oxford Cambridge and RSA Examinations
General Certificate of Secondary Education

PHYSICS

1982/3

PAPER 3

FOUNDATION TIER

Specimen Paper 2003

Candidates answer on the question paper.

Additional materials:

Pencil, Ruler (cm, mm)

TIME 45 minutes

Candidate Name

Centre Number

Candidate Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer all the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 50.
- *You will be awarded marks for the quality of written communication where an answer requires a piece of extended writing.*

Question number	For examiner's use only
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

1 This question is about a guitar.



(a) One of the guitar strings is plucked to make a note.

Suggest **one** way of making a note of a higher frequency on this string.

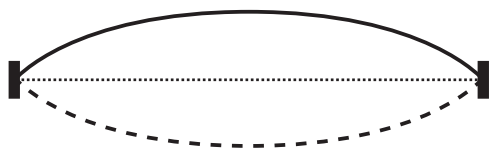
_____ [1]

(b) Guitar strings can vibrate in different ways.

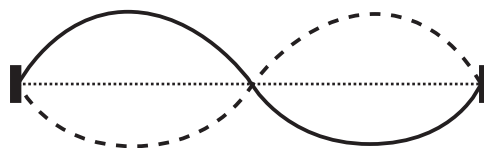
The string is fixed at each end.



Two possible modes of vibration are shown below.



frequency of 200 Hz



frequency of 400 Hz

(i) Finish the diagram below to show the next mode of vibration.



(ii) Write down the frequency of this note. Choose from this list.

- 100 600 1200

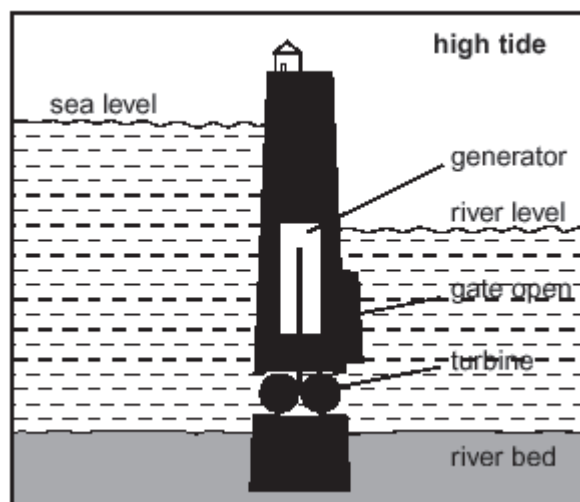
_____ [1]

[Total: 3]

- 2 This question is about generating electricity.

A dam has been built across a river where it meets the sea.

The diagram shows the water levels around the dam at high tide.



The dam contains a tidal power station. Tides are a renewable source of energy.

- (a) Describe how the energy of the water is used to produce electricity.

[2]

- (b) Write down one other renewable source of energy which is used to generate electricity.

[1]

- (c) You are a scientist who wants to use **more** renewable energy.
Suggest how you would persuade people to want more renewable energy sources
You will be given credit for the correct use of technical terms and for the correct use of spelling, punctuation and grammar.

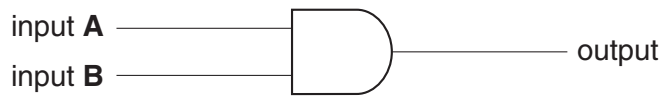
[4]

[Total: 7]

- 3 Neil has a cooling fan in his room. He is going to use a logic circuit to control the fan.

- (a) Complete the truth tables below to show how AND and OR gates operate.

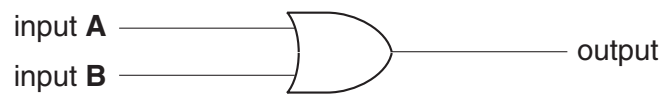
- (i) AND gate



input A	input B	output (HIGH or LOW)
LOW	LOW	_____
LOW	HIGH	_____
HIGH	LOW	_____
HIGH	HIGH	_____

[2]

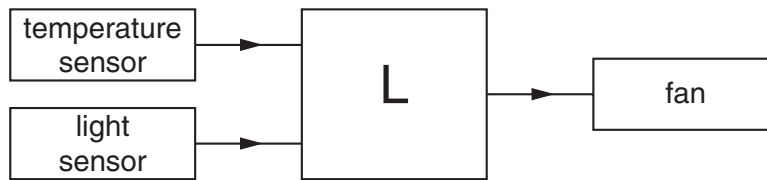
- (ii) OR gate



input A	input B	output (HIGH or LOW)
LOW	LOW	_____
LOW	HIGH	_____
HIGH	LOW	_____
HIGH	HIGH	_____

[2]

- (b) Neil is using a temperature sensor and a light sensor to control the fan.



The temperature sensor output is HIGH when it is hot, and LOW when it is cold.

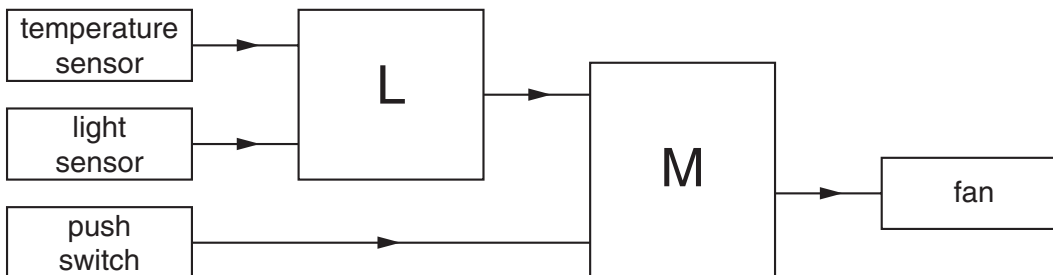
The light sensor output is HIGH when it is light, and LOW when it is dark.

Neil wants the fan to come ON when it is hot and light.

Give the **name** of the logic gate, L.

_____ [1]

- (c) To check that the fan works properly, Neil adds a push switch to test the fan.



The output from the push switch is only HIGH when Neil pushes it.

He wants the fan to come on as it did before, or when he pushes the switch.

Give the **name** of the logic gate, M.

_____ [1]

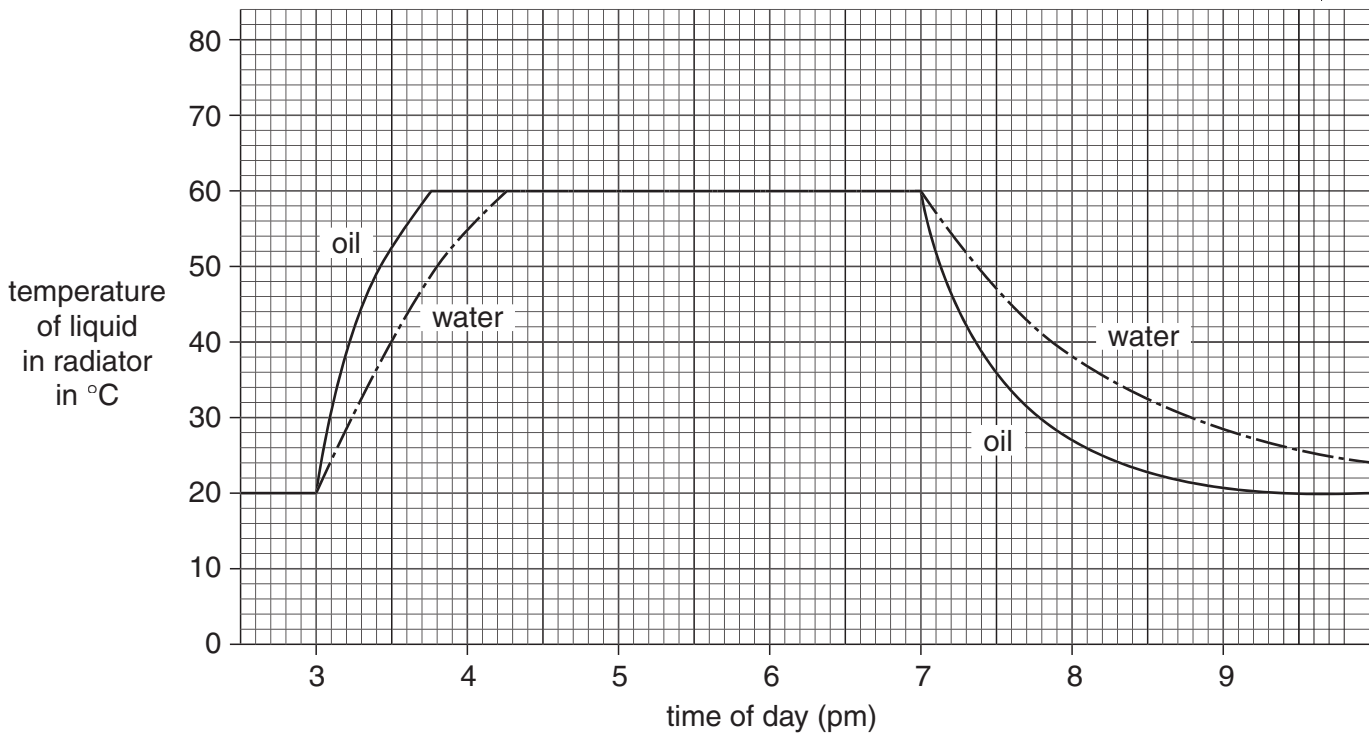
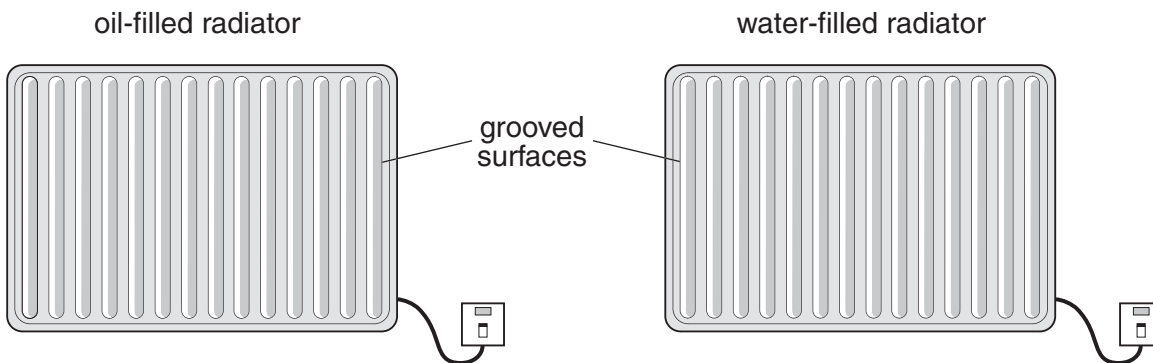
- (d) Suggest **one** reason for using this type of circuit to control a fan.

_____ [1]

[Total: 7]

- 4 A room contains two electrically heated radiators.

The radiators are exactly the same but contain different liquids.



- (a) The radiators are switched on at the mains at 3 pm and left on for 4 hours.

The graph shows how the temperature of the liquid in each radiator changes.

- (i) How long does it take the oil-filled radiators to reach 60 °C?

_____ minutes [1]

- (ii) The oil-filled radiator heats up faster than the water-filled radiator.

What is the **biggest** difference between the temperatures of the two radiators during the heating-up time?

_____ °C [1]

- (b) Each radiator contains the same mass of liquid. Explain why the oil-filled radiator heats up faster than the water-filled radiator.

 [2]

- (c) The water-filled radiator contains 10 kg of water.
Calculate the energy that needs to be transferred to raise the temperature of the water in this radiator by 20 °C.

The specific heat capacity of the water is 4000 J/kg°C.

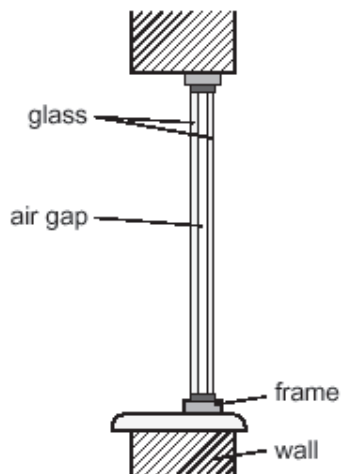
Use the equation below. You **must** show how you work out your answer.

energy transfer = mass × specific heat capacity × temperature change

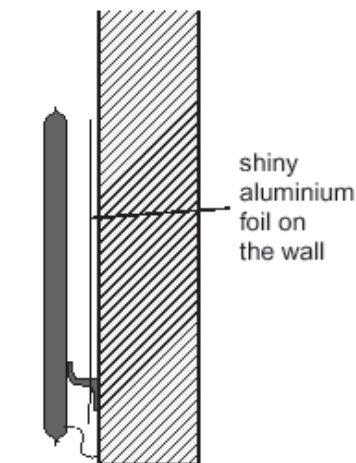
energy transfer = _____ unit _____ [2]

[Total: 6]

5 This question is about keeping a house warm.
A house has been insulated in these two ways.



The windows are double glazed



There is shiny aluminium foil on the wall behind the radiators

(a) Describe how each of these ways helps to keep the house warm. Use your ideas about conduction, convection and radiation.

(i) Double glazing.

[2]

(ii) Putting shiny aluminium foil on the wall behind a radiator.

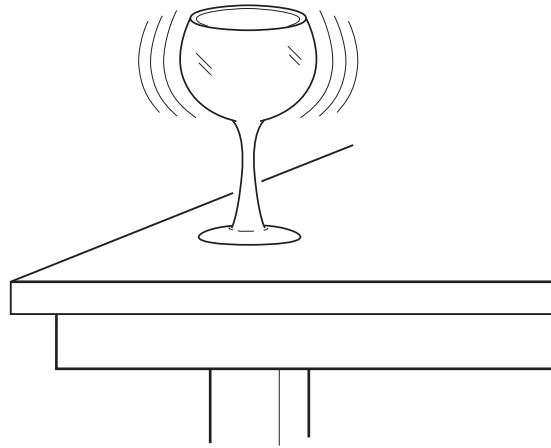
You will be given credit for the correct use of technical terms and for the correct use of spelling, punctuation and grammar.

[3]

[Total: 5]

6 This question is about sounds from loudspeakers.

- (a) Sounds of a particular pitch makes an empty wine glass vibrate strongly. Sounds of other pitches do not affect the glass noticeably.



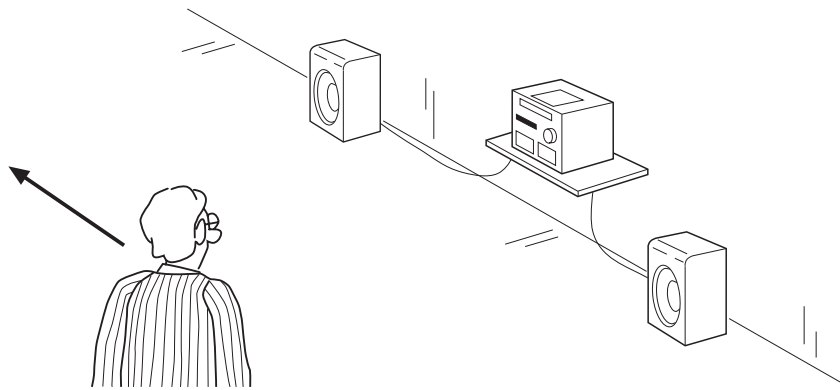
- (i) What is this effect called?

_____ [1]

- (ii) Why does this happen?

_____ [1]

- (b) A pair of loudspeakers each produces a note of constant loudness and frequency. A person walking slowly across the room notices that the sound he hears gets louder, then quieter and then louder again.



What is the name of this effect?

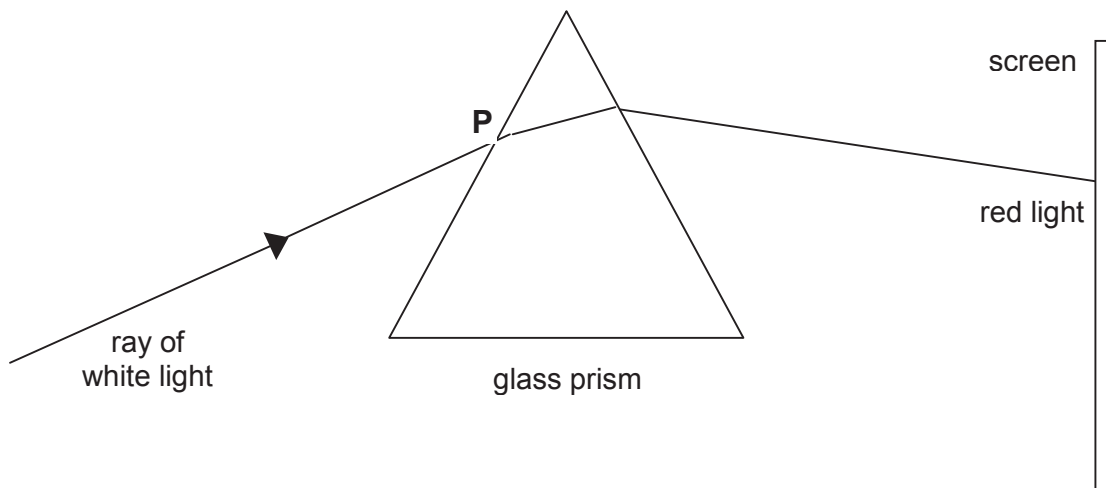
_____ [1]

[Total: 3]

7 This question is about how light is refracted by glass.

(a) The diagram shows a ray of white light striking a glass prism.

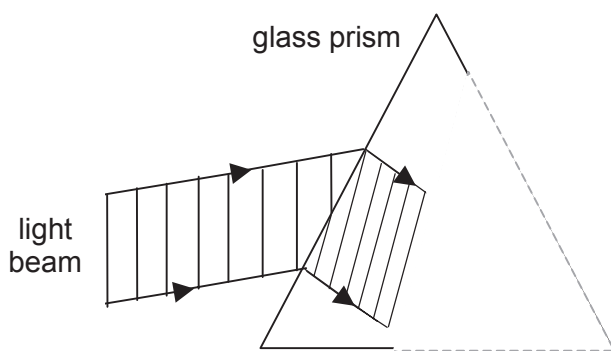
The path of the red light from **P** to the screen is shown.



Draw on the diagram the path of the blue light from **P** to the screen. [2]

(b) Light can be represented as waves or rays.

(i) This diagram represents light waves passing into the prism.



What happens to the speed, frequency and wavelength of the light waves?

Put a tick (✓) in the correct box for each quantity.

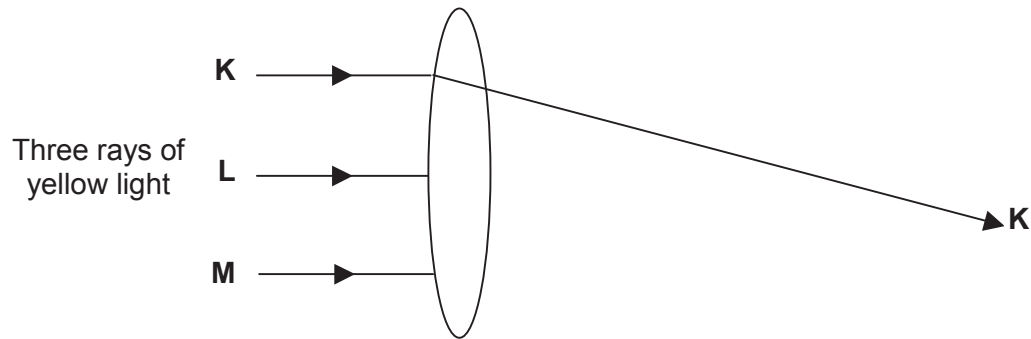
quantity	decreases	stays the same	increases
speed			
frequency			
wavelength			

[3]

(ii) This diagram represents three parallel rays of yellow light striking a convex lens.

Ray **K** has been drawn.

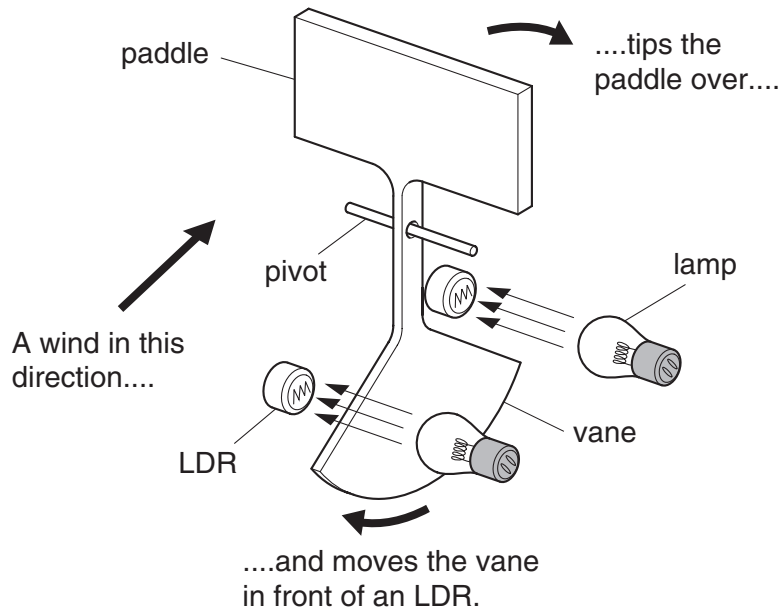
Finish the diagram by drawing rays **L** and **M**.



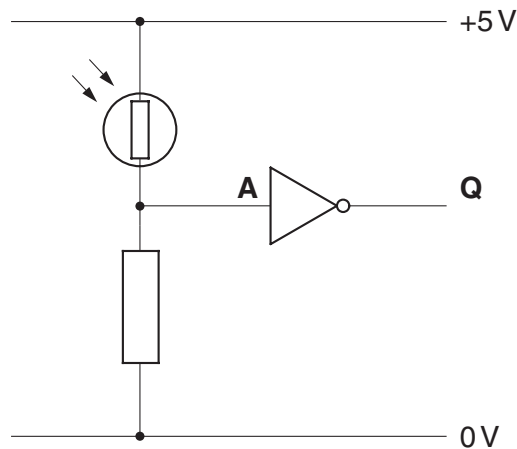
[2]

[Total: 7]

- 8 It is dangerous for aircraft to take off or land when there is a strong wind across the runway. An airport has installed this device to detect these dangerous cross winds.



The lamps shine light onto the LDRs. Any cross wind pushes the vane between the lamp and one of the LDRs. Here is the circuit for **one** of the LDRs.



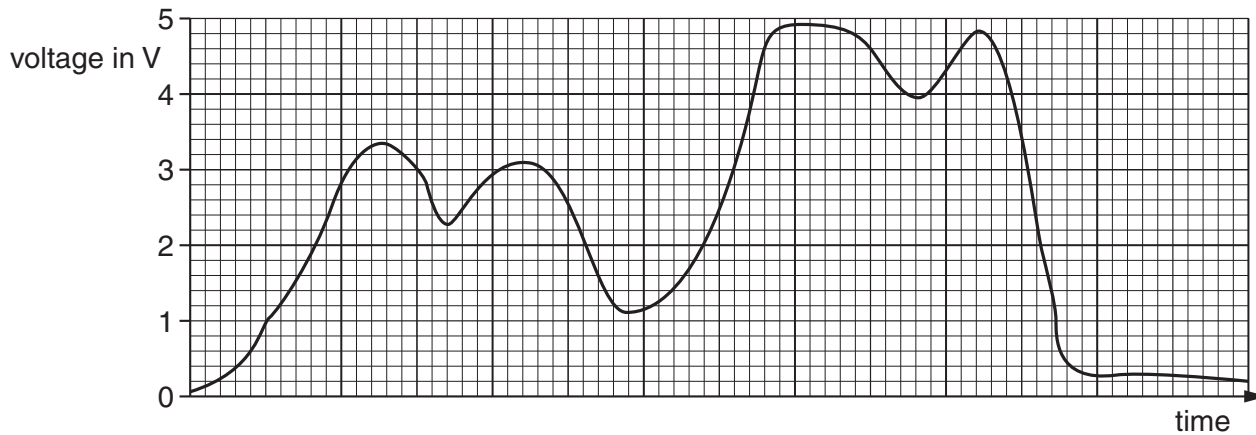
- (a) Use the words **high** or **low** to complete the sentences.

When there is no wind, there is lots of light on the LDR. It has a _____ resistance and the voltage at **A** is _____ .

In strong wind, there is no light on the LDR. So it has a _____ resistance and the voltage at **A** is _____ .

[2]

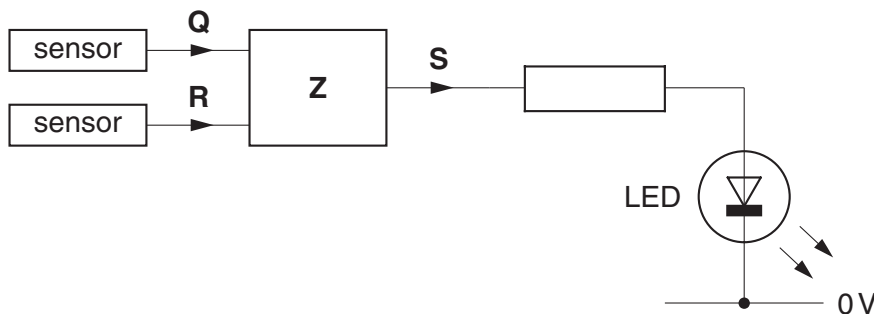
(b) The graph shows how the voltage at **A** changes during a day.



voltage at A	voltage at Q
less than 2.0 V	4.5 V
more than 2.0 V	0.5 V

On the **graph** show how the voltage at **Q** changes during the day. Use the data in the table. [3]

(c) A logic gate **Z** combines the signals from the two sensors.



The LED must glow if the cross wind is dangerous. The output from each sensor is LOW when there is no wind.

(i) Complete the table.

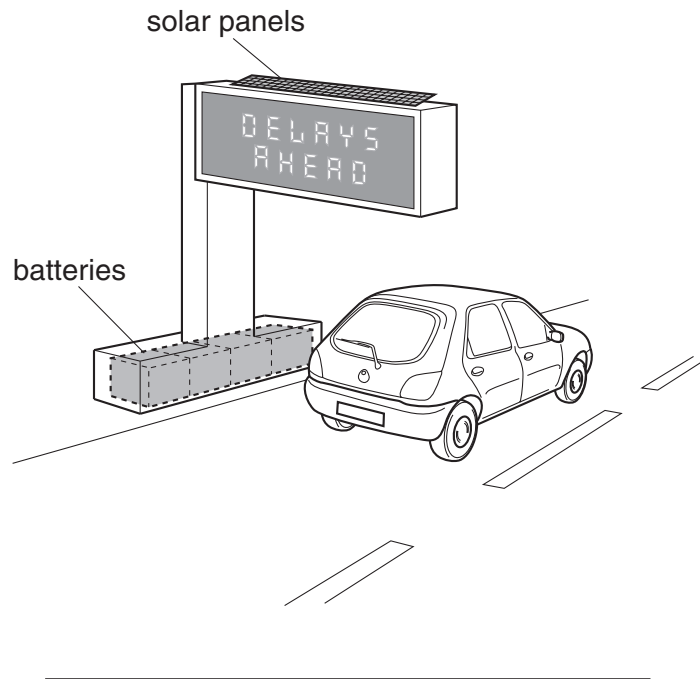
R	Q	S
LOW	LOW	
LOW	HIGH	
HIGH	LOW	
HIGH	HIGH	HIGH

[2]

(ii) Name the logic gate **Z**. _____ [1]

[Total: 8]

- 9 On the motorway, a driver notices that some road signs are powered by batteries. The batteries are recharged by solar cells.



- (a) What is the energy source for **solar** cells?

_____ [1]

- (b) For every 100 J of energy supplied to the sign by the batteries, the sign produces 90 J of useful energy.

- (i) What type of energy does the other 10 J become?

_____ [1]

- (ii) Use the formula

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100\%$$

to calculate the efficiency of the road sign.

efficiency = _____ [2]

[Total: 4]

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