

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Spring 2003



SCIENCE: PHYSICS (MODULAR)
Physics in Action (Module 23)

346023

Wednesday 5 March 2003 Morning Session

In addition to this paper you will require:

- an HB pencil and a rubber;
- an answer sheet.

You may use a calculator.

Time allowed: 30 minutes

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Instructions

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title “Physics in Action” printed on it.
- Attempt **one Tier only, either** the Foundation Tier **or** the Higher Tier.
- Answer **all** the questions for the Tier you are attempting.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Mark your responses on the separate answer sheet only. Rough work may be done on the question paper.
- Mark the best responses by using a thick pencil stroke to fill in the box. Use an HB pencil. Make sure the pencil stroke does **not** extend beyond the box. Do **not** use ink or ball-point pen. If you wish to change your answer, rub out your first answer completely. See below.

Examples:

	1	2	3	4
	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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QUESTION XXX				
xxx.1	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
xxx.2	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
xxx.3	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
xxx.4	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D

Information

- The maximum mark for this paper is 36.

Advice

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you rub out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION A

Questions **ONE** to **FIVE**.

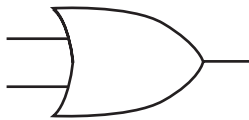
In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

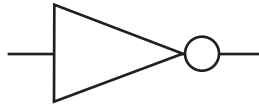
Mark your choices on the answer sheet.

QUESTION ONE

These circuit symbols are used in electronic circuits.



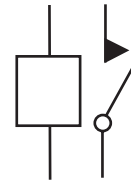
1



2



3



4

Match each component in the list with its symbol 1–4.

capacitor

NOT gate

OR gate

relay

QUESTION TWO

In electronic circuits, components have different functions.

Match the words from the list with the components 1–4 in the table.

AND gate

buzzer

capacitor

LDR

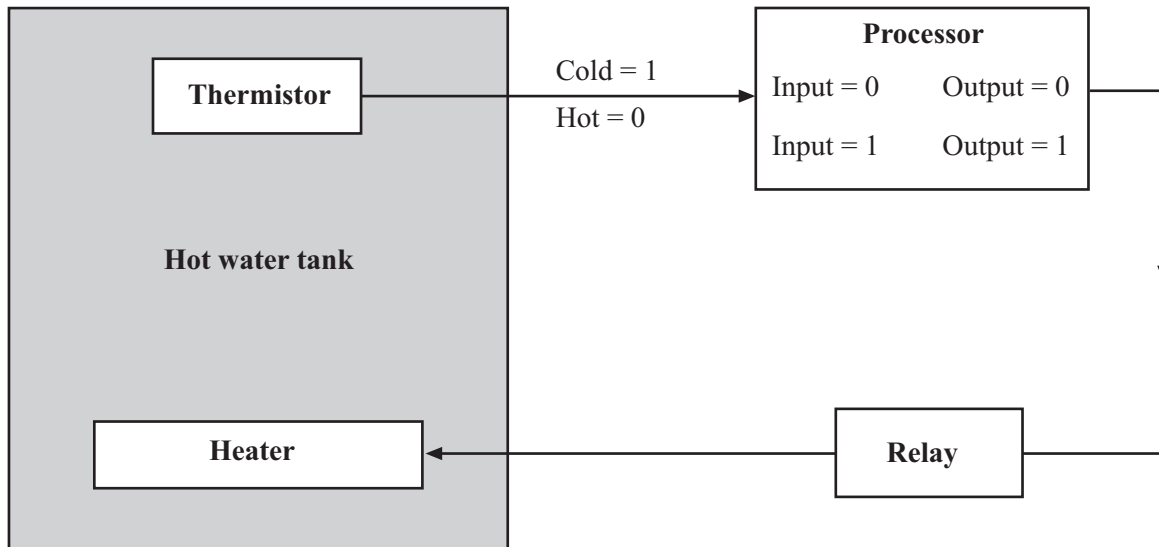
Component	Function
1	used as a light sensor
2	used as an output device
3	used as a processor
4	used as a timer

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION THREE

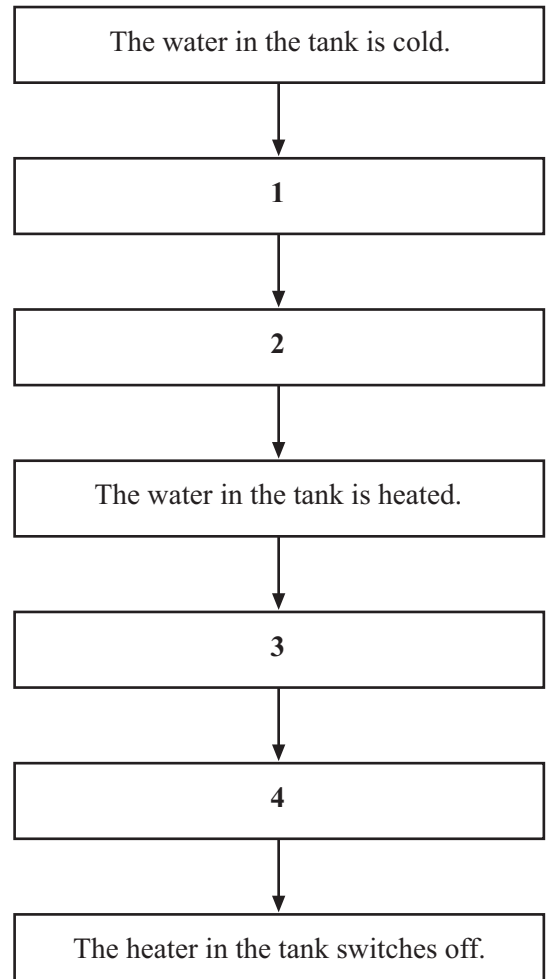
This question is about an electronic system that controls the heater in a hot water tank.



The boxes below explain how the system works.

Choose sentences **P**, **Q**, **R** and **S** from the list to fill the boxes **1–4**.

- P** The heater in the tank switches on.
- Q** The thermistor gives a high output.
- R** The thermistor gives a low output.
- S** The water reaches the required temperature.



QUESTION FOUR

This question is about a relay.

Match words from the list with each of the spaces **1–4** in the sentences.

coil

output

processor

switch

A relay can be used as a **1** for an output device.

The **2** from an electronic system gives a small current.

This passes through the **3** of the relay.

In this way, the output device is controlled by the **4**

QUESTION FIVE

Capacitors can be used in electronic circuits.

Match words from the list with each of the spaces **1–4** in the sentences.

conductor

current

resistance

voltage

When a metal wire is connected across a charged capacitor, a **1** flows in the circuit.

The metal wire is a **2**

During the discharging process, the **3** across the ends of the capacitor decreases.

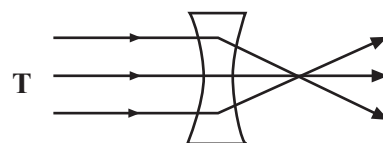
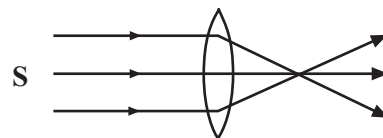
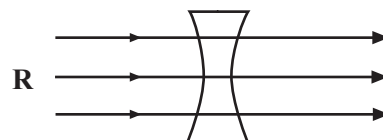
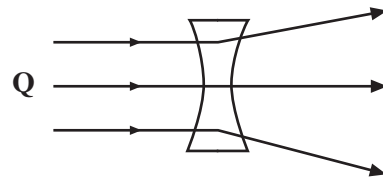
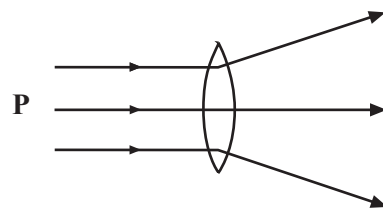
The greater the **4** of the discharging circuit, the longer this process takes.

Turn over ►

SECTION BQuestions **SIX** and **SEVEN**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

QUESTION SIX

There are converging and diverging lenses.

Which **two** of the diagrams, **P**, **Q**, **R**, **S** or **T**, correctly show parallel rays of light passing through a lens?

QUESTION SEVEN

In a camera, the lens forms an image on a photographic film.

Which **two** of the following statements about a camera are correct?

the camera uses a converging lens

the camera uses a diverging lens

the image is further from the lens than the object

the image is magnified

the image is nearer to the lens than the object

TURN OVER FOR THE NEXT QUESTION

Turn over ►

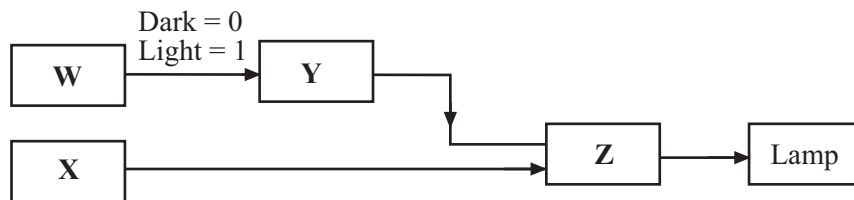
SECTION CQuestions **EIGHT** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION EIGHT

The electronic system shown in the diagram lights a lamp automatically when it becomes dark. It also allows the lamp to be turned on manually at any time.

**8.1** For **X** you could use

- A** an AND gate.
- B** an LDR.
- C** a switch.
- D** a thermistor.

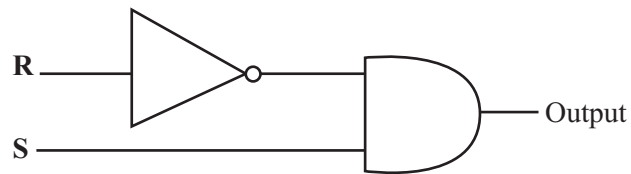
8.2 For **Y** you could use

- A** an LDR.
- B** a magnetic switch.
- C** a NOT gate.
- D** an OR gate.

8.3 For **Z** you could use

- A an AND gate.
- B a motor.
- C an OR gate.
- D a switch.

8.4 The diagram shows another circuit with two logic gates combined.



Which row of the truth table, **A**, **B**, **C** or **D**, is **not** correct for this system?

	Input R	Input S	Output
A	0	0	0
B	0	1	0
C	1	0	0
D	1	1	0

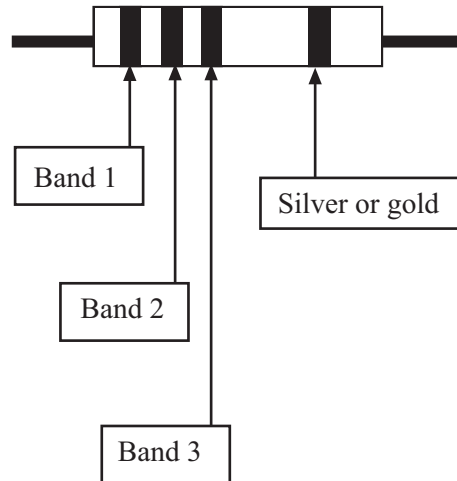
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The table and the diagram show the colour code for resistors.

0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Grey
9	White



9.1 What value of resistance is shown by the following code?

Band 1 Blue

Band 2 Grey

Band 3 Brown

- A 68 ohms
- B 680 ohms
- C 68 kilohms
- D 680 kilohms

9.2 What colour bands, from left to right, would be on a 56 ohm resistor?

- A black green blue
- B blue green black
- C green blue black
- D green blue brown

9.3 What colour bands, from left to right, would be on a 1 kilohm resistor?

- A** brown black brown
- B** brown black red
- C** brown brown red
- D** brown orange black

9.4 A thermistor does not have this colour code because

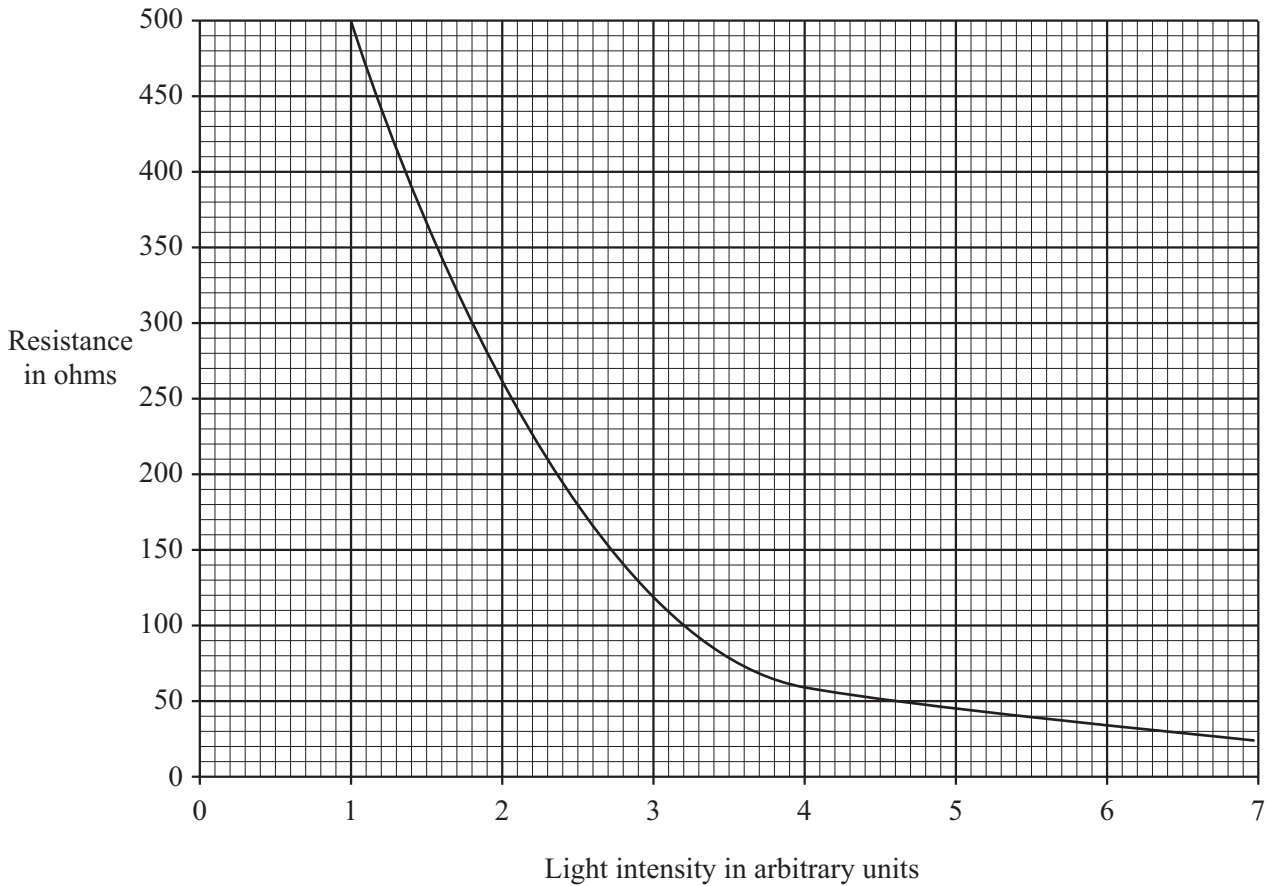
- A** it does not have a constant resistance.
- B** it is an input sensor.
- C** it is very small.
- D** its resistance is too high for the code.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

The graph shows how the resistance of an LDR changes with light intensity.



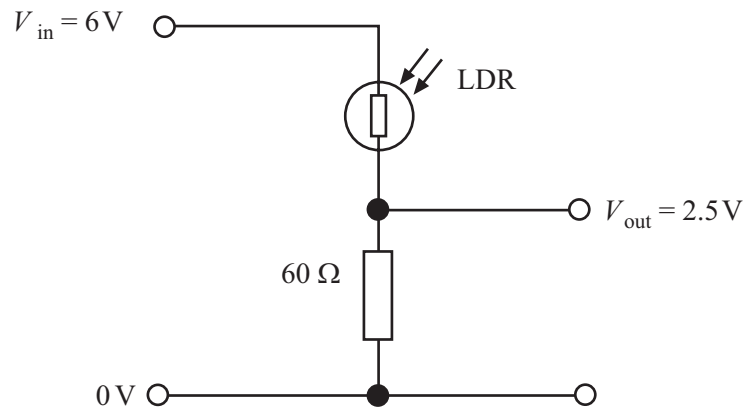
10.1 What happens to the resistance of the LDR as the light intensity is increased?

- A** It decreases, quickly at first and then more slowly
- B** It decreases, slowly at first and then more quickly
- C** It increases, quickly at first and then more slowly
- D** It increases, slowly at first and then more quickly

10.2 What value of light intensity would give the LDR a resistance of 100 ohms?

- A** 2.7 units
- B** 3.0 units
- C** 3.2 units
- D** 4.0 units

The diagram shows a potential divider circuit.



10.3 What is the voltage across the LDR?

- A 0 V
- B 2.5 V
- C 3.5 V
- D 6.0 V

10.4 Use the graph and the potential divider circuit to answer this question.

What value of light intensity would give a V_{out} of 3 V?

- A 2 units
- B 3 units
- C 4 units
- D 5 units

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier is earlier in this booklet.

HIGHER TIER

SECTION A

Questions **ONE** and **TWO**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

Capacitors can be used in electronic circuits.

Match words from the list with each of the spaces **1–4** in the sentences.

conductor

current

resistance

voltage

When a metal wire is connected across a charged capacitor, a **1** flows in the circuit.

The metal wire is a **2**

During the discharging process, the **3** across the ends of the capacitor decreases.

The greater the **4** of the discharging circuit, the longer this process takes.

QUESTION TWO

The diagram shows a fire alarm circuit.

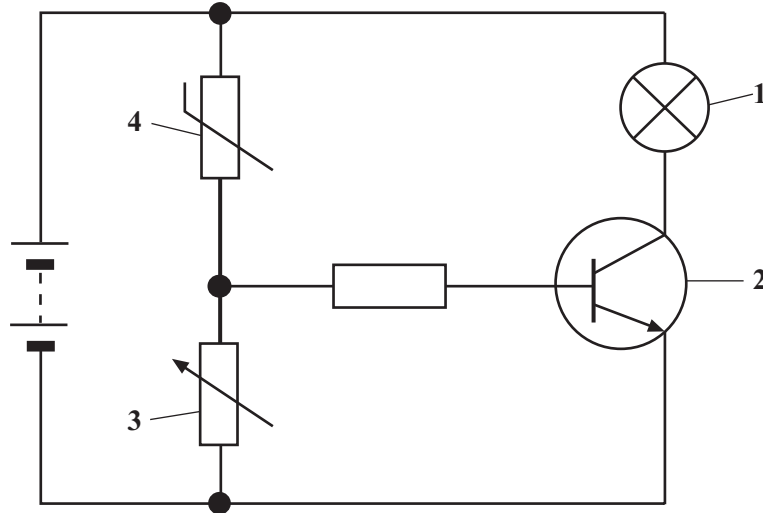
Match words from the list with each of the components 1–4 in the circuit.

controls the circuit's sensitivity

input sensor

output device

acts as a switch



TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION BQuestions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

QUESTION THREE

In a camera, the lens forms an image on a photographic film.

Which **two** of the following statements about a camera are correct?**the camera uses a converging lens****the camera uses a diverging lens****the image is further from the lens than the object****the image is magnified****the image is nearer to the lens than the object****QUESTION FOUR**

Eighty percent of the teenage and adult population of the UK now use mobile phones.

Which **two** of the following are **major** disadvantages of all types of mobile phone?**their batteries often need charging****they are always very expensive to use****they can only be used in one country****they distract car drivers****they need a network of unsightly transmission masts**

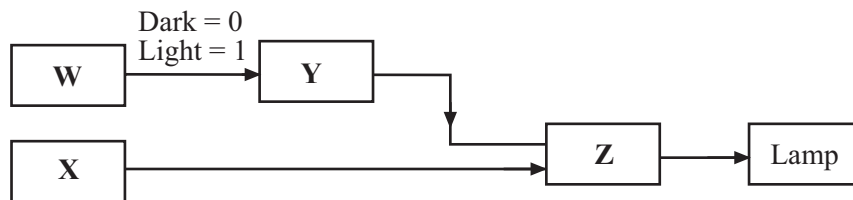
SECTION CQuestions **FIVE** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION FIVE

The electronic system shown in the diagram lights a lamp automatically when it becomes dark. It also allows the lamp to be turned on manually at any time.



5.1 For **X** you could use

- A** an AND gate.
- B** an LDR.
- C** a switch.
- D** a thermistor.

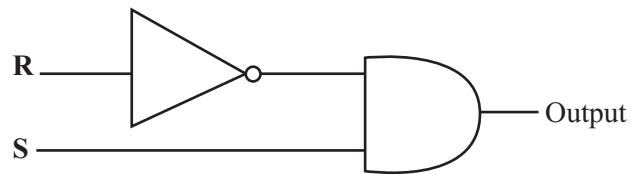
5.2 For **Y** you could use

- A** an LDR.
- B** a magnetic switch.
- C** a NOT gate.
- D** an OR gate.

5.3 For **Z** you could use

- A an AND gate.
- B a motor.
- C an OR gate.
- D a switch.

5.4 The diagram shows another circuit with two logic gates combined.



Which row of the truth table, **A**, **B**, **C** or **D**, is **not** correct for this system?

	Input R	Input S	Output
A	0	0	0
B	0	1	0
C	1	0	0
D	1	1	0

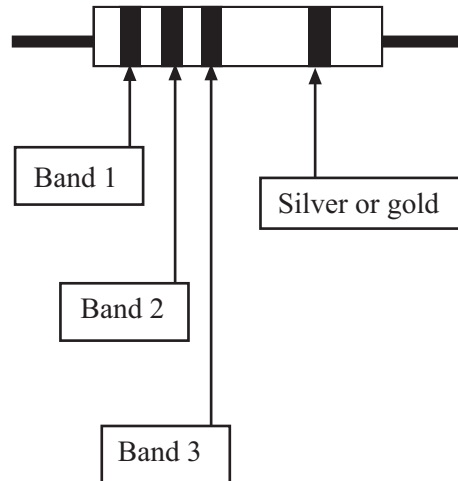
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SIX

The table and the diagram show the colour code for resistors.

0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Grey
9	White



6.1 What value of resistance is shown by the following code?

Band 1 Blue

Band 2 Grey

Band 3 Brown

- A 68 ohms
- B 680 ohms
- C 68 kilohms
- D 680 kilohms

6.2 What colour bands, from left to right, would be on a 56 ohm resistor?

- A black green blue
- B blue green black
- C green blue black
- D green blue brown

6.3 What colour bands, from left to right, would be on a 1 kilohm resistor?

- A** brown black brown
- B** brown black red
- C** brown brown red
- D** brown orange black

6.4 A thermistor does not have this colour code because

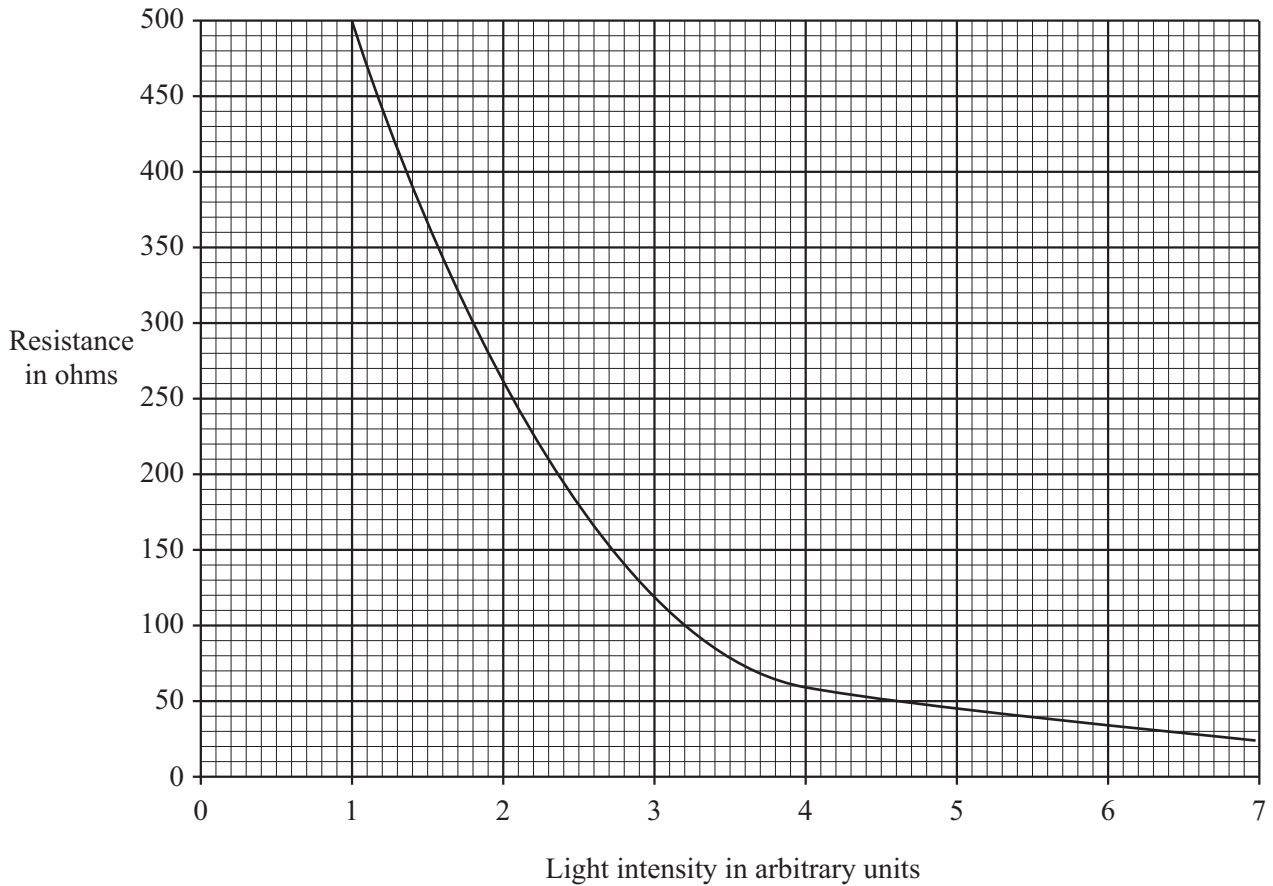
- A** it does not have a constant resistance.
- B** it is an input sensor.
- C** it is very small.
- D** its resistance is too high for the code.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SEVEN

The graph shows how the resistance of an LDR changes with light intensity.



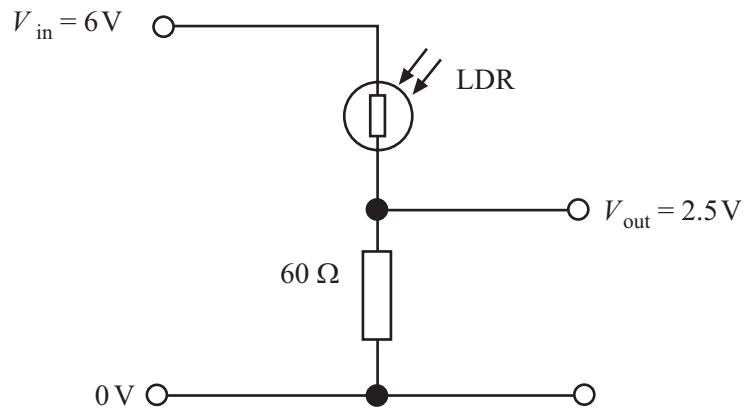
7.1 What happens to the resistance of the LDR as the light intensity is increased?

- A** It decreases, quickly at first and then more slowly
- B** It decreases, slowly at first and then more quickly
- C** It increases, quickly at first and then more slowly
- D** It increases, slowly at first and then more quickly

7.2 What value of light intensity would give the LDR a resistance of 100 ohms?

- A** 2.7 units
- B** 3.0 units
- C** 3.2 units
- D** 4.0 units

The diagram shows a potential divider circuit.



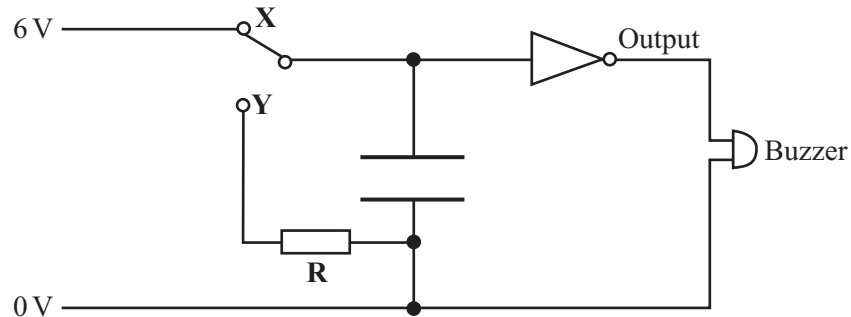
- 7.3 What is the voltage across the LDR?
- A 0 V
 - B 2.5 V
 - C 3.5 V
 - D 6.0 V
- 7.4 Use the graph and the potential divider circuit to answer this question.
- What value of light intensity would give a V_{out} of 3 V?
- A 2 units
 - B 3 units
 - C 4 units
 - D 5 units

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION EIGHT

The diagram shows a circuit in which a capacitor acts as an input sensor.



- 8.1** When the switch is in position **X**
- A** the capacitor is fully charged and the output of the logic gate is 0.
 - B** the capacitor is fully charged and the output of the logic gate is 1.
 - C** the capacitor is uncharged and the output of the logic gate is 0.
 - D** the capacitor is uncharged and the output of the logic gate is 1.
- 8.2** The switch is now changed to position **Y**.
- What happens **next**?
- A** The capacitor starts to charge and the voltage across it falls
 - B** The capacitor starts to charge and the voltage across it rises
 - C** The capacitor starts to discharge and the voltage across it falls
 - D** The capacitor starts to discharge and the voltage across it rises
- 8.3** What would give the greatest increase in the time taken for the output to change?
- A** Doubling the resistance of **R** and doubling the capacitance
 - B** Doubling the resistance of **R** and halving the capacitance
 - C** Halving the resistance of **R** and doubling the capacitance
 - D** Halving the resistance of **R** and halving the capacitance

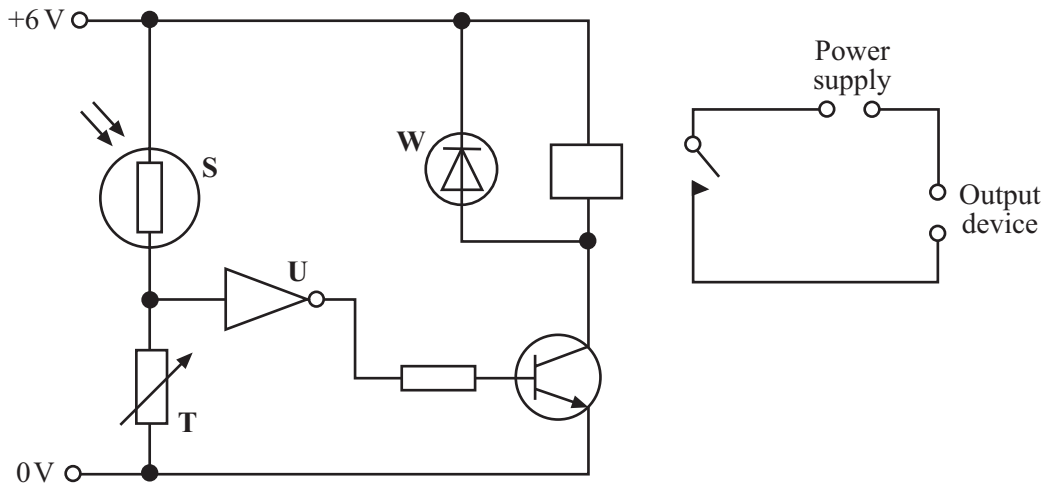
8.4 When will the buzzer sound?

- A** Immediately, when the switch changes to position **X**
- B** Some time after the switch changes to position **X**
- C** Immediately, when the switch changes to position **Y**
- D** Some time after the switch changes to position **Y**

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

The diagram shows the circuit of an electronic control system.



- 9.1 In the dark,
- A the resistance of **S** is high and the input to **U** is high.
 - B the resistance of **S** is high and the input to **U** is low.
 - C the resistance of **S** is low and the input to **U** is high.
 - D the resistance of **S** is low and the input to **U** is low.
- 9.2 If **S** and **T** are interchanged, the system
- A stops working.
 - B switches on in the dark.
 - C switches on in the light.
 - D works as before only if **W** is reversed.

9.3 Component U is removed from the original circuit, and the circuit is reconnected.

The system

- A** gives a much higher output.
- B** no longer works.
- C** switches on in the dark.
- D** switches on in the light.

9.4 The original circuit is changed to make a heater switch off when the temperature of a hot-water system becomes too high.

A suitable thermistor is put in place of

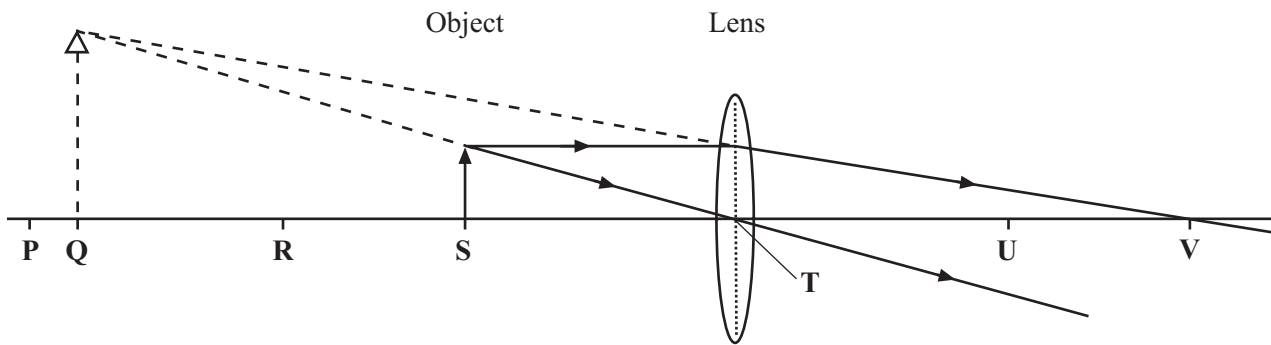
- A** S
- B** T
- C** U
- D** W

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

The diagram shows a convex lens forming a virtual image. The diagram is drawn to scale.



10.1 The image is formed at

- A P
- B Q
- C R
- D S

10.2 The image is

- A upright and larger than the object.
- B upright and smaller than the object.
- C upside down and larger than the object.
- D upside down and smaller than the object.

10.3 The focus of the lens is at

- A Q
- B S
- C T
- D V

10.4 A real image could be produced with this lens by placing the object between

- A** P and R.
- B** R and S.
- C** S and T.
- D** T and U.

END OF TEST