

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
June 2004



PHYSICS (MODULAR)
Physics in Action (Module 23)

346023

Tuesday 29 June 2004 Morning Session

In addition to this paper you will require:

- a ball-point pen;
- an answer sheet.

You may use a calculator.

Time allowed: 30 minutes

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.
- 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.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only. Rough work may be done on the question paper.

Instructions for recording answers

- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

- Do **not** extend beyond the circles.

- If you want to change your answer, **you must** cross out your original answer, as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

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 cross 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

Match input sensors from the list with the numbers **1–4** in the table.

LDR

moisture switch

pressure switch

thermistor

Sensor	Where the input sensor may be used
1	under a doormat connected to an alarm
2	with a heater
3	with a watering system
4	with street lights

QUESTION TWO

Different parts of electronic systems do different jobs.

Match jobs from the list with the numbers 1–4 in the table.

acting as a switch

carrying out actions

detecting changes in the environment

making decisions about the action to take

Job	The part of the electronic system
1	input sensor
2	output device
3	processor
4	relay

QUESTION THREE

Match words from the list with the numbers 1–4 in the sentences.

LEDs

motors

OR gates

resistors

..... **1** are used to control the current in circuits.

..... **2** are used in processors.

..... **3** can be used to produce light in output devices.

..... **4** can be used to produce movement in output devices.

Turn over ►

QUESTION FOUR


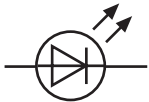
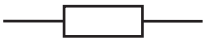

Match words from the list with the numbers 1–4 in the table.

capacitor

LED

OR gate

resistor

	Symbol
1	
2	
3	
4	

QUESTION FIVE

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

capacitor

conductor

current

potential difference (voltage)

A **1** is a device which stores electric charge.

When a **2** is connected across this device, there is a **3** in the circuit.

This causes the **4** across the device to decrease.

TURN OVER FOR THE NEXT QUESTION

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

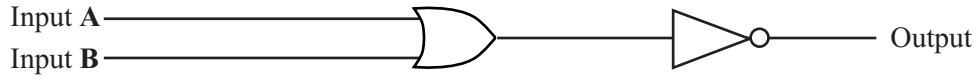
Optical devices use lenses to produce images.

Which **two** of the following statements, **P**, **Q**, **R**, **S** and **T**, are correct?

- P** converging lenses never produce real images
- Q** virtual images can be produced on a screen
- R** cameras use converging lenses to produce real images on the film
- S** the image formed by a camera lens is usually larger than the object
- T** in a simple camera, the distance of the image from the lens is less than the distance of the object from the lens

QUESTION SEVEN

The diagram shows an electronic system.



A truth table is shown below.

	Input A	Input B	Output
W	0	0	1
X	0	1	1
Y	1	0	0
Z	1	1	0

Which **two** of the following statements are correct?

all the lines in the table are correct

lines W and Y are correct

lines X and Z are correct

line X is the only line which is wrong

line Z is the only line which is wrong

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

A gardener is going to make an electronic system which will open a window in a greenhouse when the weather is warm and sunny.

8.1 Which output device will she need?

- A A buzzer
- B A heater
- C A lamp
- D A motor

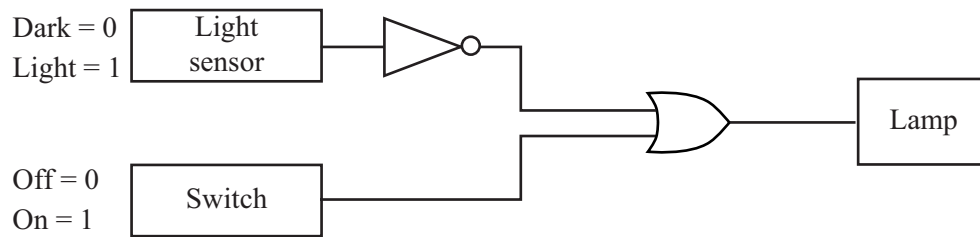
8.2 Which input sensors will she need?

- A An LDR and a moisture switch
- B An LDR and a pressure switch
- C An LDR and a thermistor
- D A moisture switch and a thermistor

8.3 Which logic gate will she need?

- A An AND gate
- B An OR gate
- C An AND gate and an OR gate
- D An OR gate and a NOT gate

The gardener designs another system to control a lamp outside the greenhouse.
The system is shown below.



8.4 When will the lamp be ON?

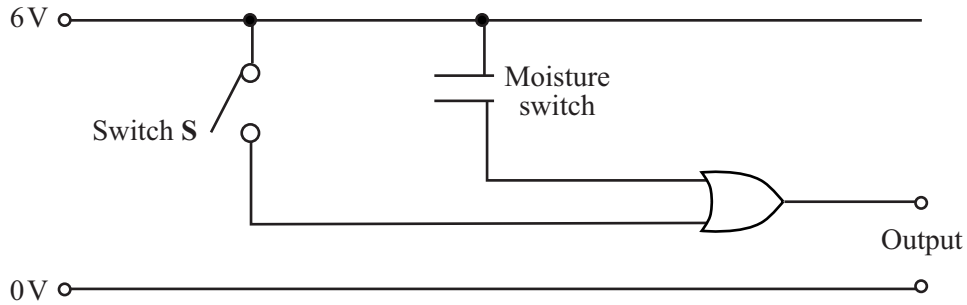
- A Only when the switch is ON
- B Only when the switch is OFF and it is cold
- C Only when the switch is ON and it is dark
- D When the switch is ON, or when it is dark

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

A car uses the electronic system shown below to operate the windscreen wipers.



9.1 The logic gate in the circuit is the

- A input sensor.
- B output device.
- C potential divider.
- D processor.

9.2 The moisture switch closes when water on the windscreen fills the space between the contacts.

The output from the system is high when

- A both switches are closed.
- B either switch is closed.
- C only switch S is closed.
- D only the moisture switch is closed.

9.3 The current from the electronic system is small.

What is used to switch on a larger current in the circuit containing the output device?

- A A capacitor
- B A diode
- C A relay
- D A variable resistor

9.4 What is the output device?

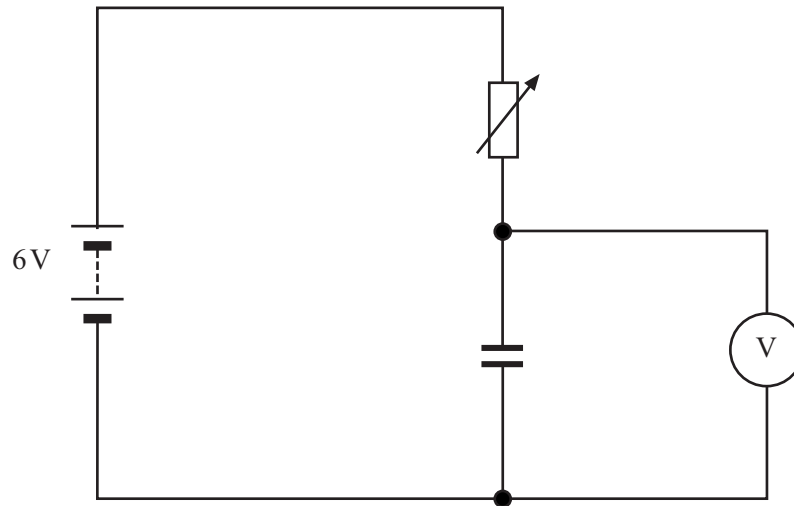
- A** A motor
- B** A relay
- C** A thermistor
- D** A transistor

TURN OVER FOR THE NEXT QUESTION

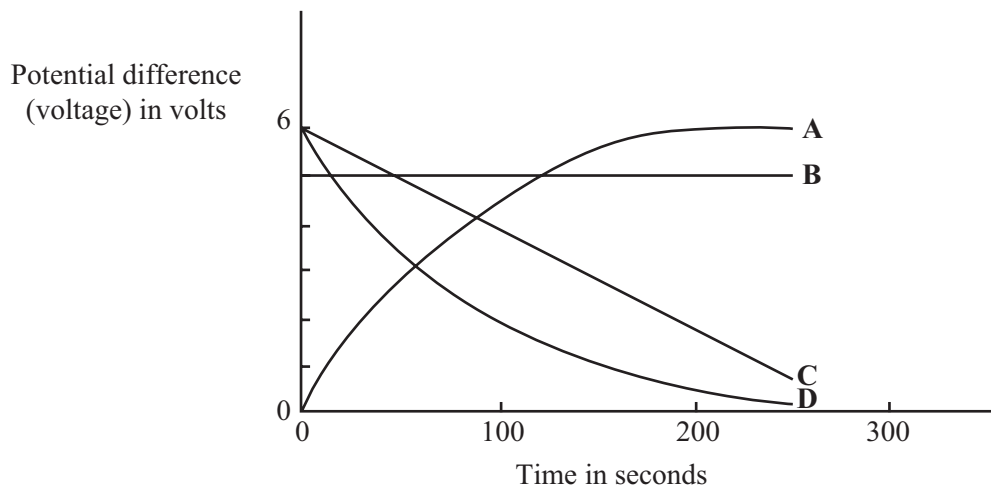
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QUESTION TEN

The circuit is used to charge a capacitor.



- 10.1 Which graph line, **A**, **B**, **C** or **D**, shows how the potential difference (voltage) across the capacitor changes as it is being charged?



10.2 The variable resistor is adjusted. It now takes a shorter time to charge the capacitor.

Why is this?

- A The capacitor stores less charge
- B The capacitor stores more charge
- C The resistance has been decreased
- D The resistance has been increased

10.3 A different capacitor is used. It has a smaller value.

Which statement about the capacitor is correct?

- A It takes a longer time to charge
- B It takes a shorter time to charge
- C The time taken to charge fully is the same
- D It never fully charges

10.4 Capacitors are used in electronic circuits as

- A output devices.
- B processors.
- C switches.
- D timers.

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier starts 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

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

capacitor

conductor

current

potential difference (voltage)

A **1** is a device which stores electric charge.

When a **2** is connected across this device, there is a **3** in the circuit.

This causes the **4** across the device to decrease.

QUESTION TWO

Using electronic systems has advantages and disadvantages.

Match words from the list with the numbers 1–4 in the sentences.

CCTV

a mobile phone

a phone mast

the Internet

..... **1** gives fast communication with almost anywhere in the world, but people are often worried about the health hazards and visual pollution associated with **2**

..... **3** gives increased security, but some people are concerned about invasion of privacy.

..... **4** allows people to shop without leaving home, but it also allows children to view unsuitable images.

TURN OVER FOR THE NEXT QUESTION

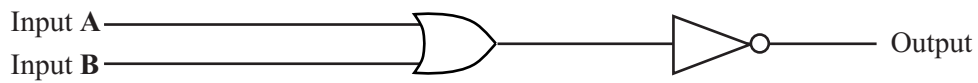
Turn over ►

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

The diagram shows an electronic system.



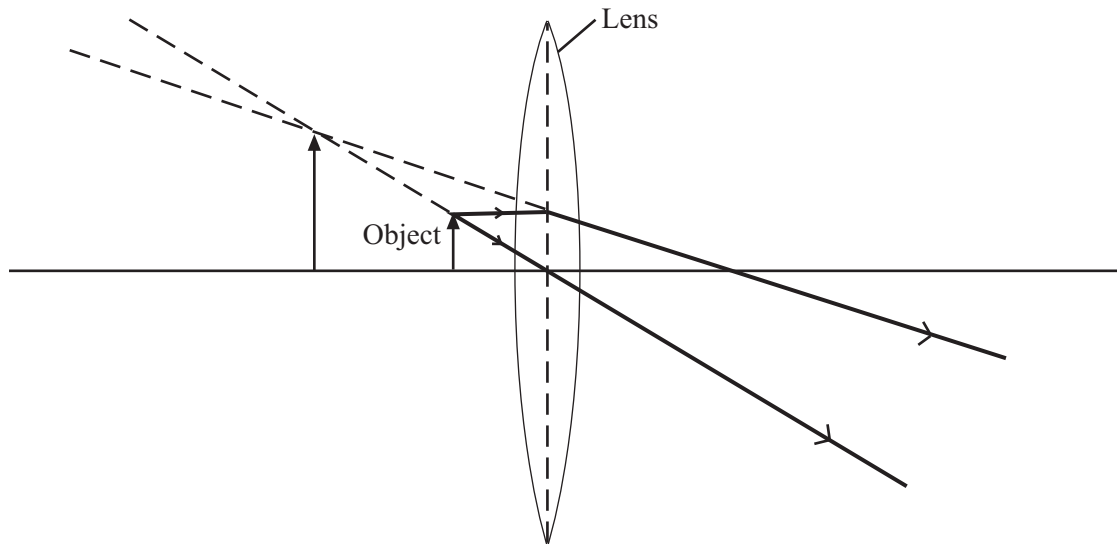
A truth table is shown below.

	Input A	Input B	Output
W	0	0	1
X	0	1	1
Y	1	0	0
Z	1	1	0

Which **two** of the following statements are correct?**all the lines in the table are correct****lines W and Y are correct****lines X and Z are correct****line X is the only line which is wrong****line Z is the only line which is wrong**

QUESTION FOUR

The ray diagram shows what happens when an object is placed in front of a convex lens.



Which **two** statements about this diagram are correct?

it shows the formation of a virtual image

it shows the principle of the camera

it shows the principle of the magnifying glass

the distance from the object to the lens is greater than the focal length

the lens shown is a diverging one

TURN OVER FOR THE NEXT QUESTION

Turn over ►

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

A gardener is going to make an electronic system which will open a window in a greenhouse when the weather is warm and sunny.

5.1 Which output device will she need?

- A A buzzer
- B A heater
- C A lamp
- D A motor

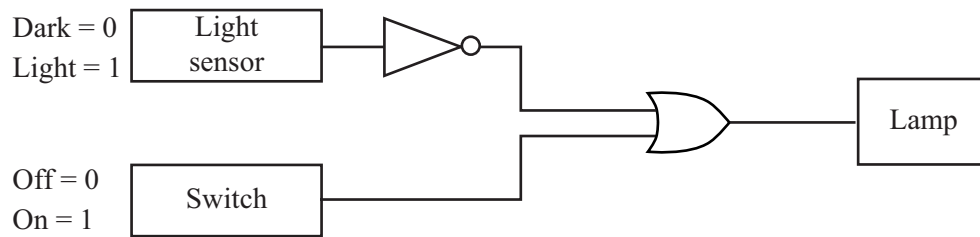
5.2 Which input sensors will she need?

- A An LDR and a moisture switch
- B An LDR and a pressure switch
- C An LDR and a thermistor
- D A moisture switch and a thermistor

5.3 Which logic gate will she need?

- A An AND gate
- B An OR gate
- C An AND gate and an OR gate
- D An OR gate and a NOT gate

The gardener designs another system to control a lamp outside the greenhouse.
The system is shown below.



5.4 When will the lamp be ON?

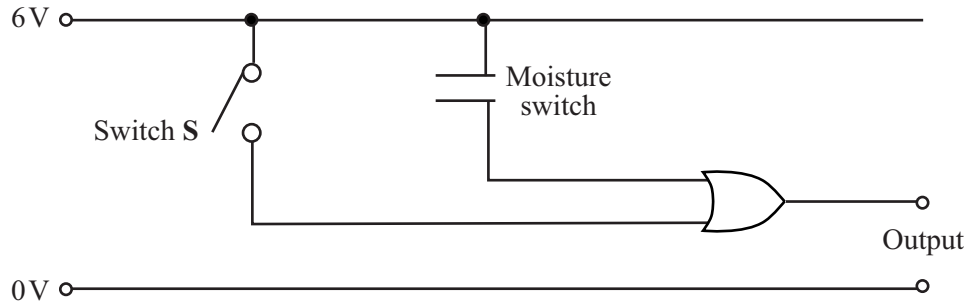
- A Only when the switch is ON
- B Only when the switch is OFF and it is cold
- C Only when the switch is ON and it is dark
- D When the switch is ON, or when it is dark

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SIX

A car uses the electronic system shown below to operate the windscreen wipers.



- 6.1** The logic gate in the circuit is the
- A input sensor.
 - B output device.
 - C potential divider.
 - D processor.
- 6.2** The moisture switch closes when water on the windscreen fills the space between the contacts.
- The output from the system is high when
- A both switches are closed.
 - B either switch is closed.
 - C only switch S is closed.
 - D only the moisture switch is closed.
- 6.3** The current from the electronic system is small.
- What is used to switch on a larger current in the circuit containing the output device?
- A A capacitor
 - B A diode
 - C A relay
 - D A variable resistor

6.4 What is the output device?

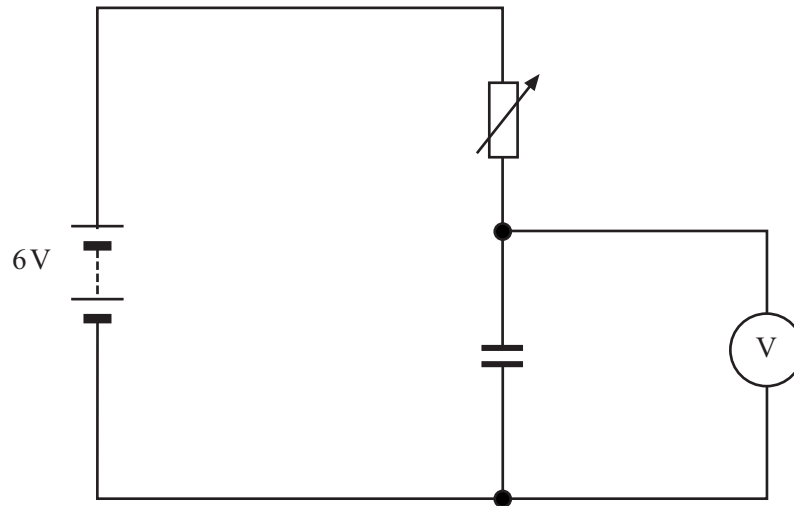
- A** A motor
- B** A relay
- C** A thermistor
- D** A transistor

TURN OVER FOR THE NEXT QUESTION

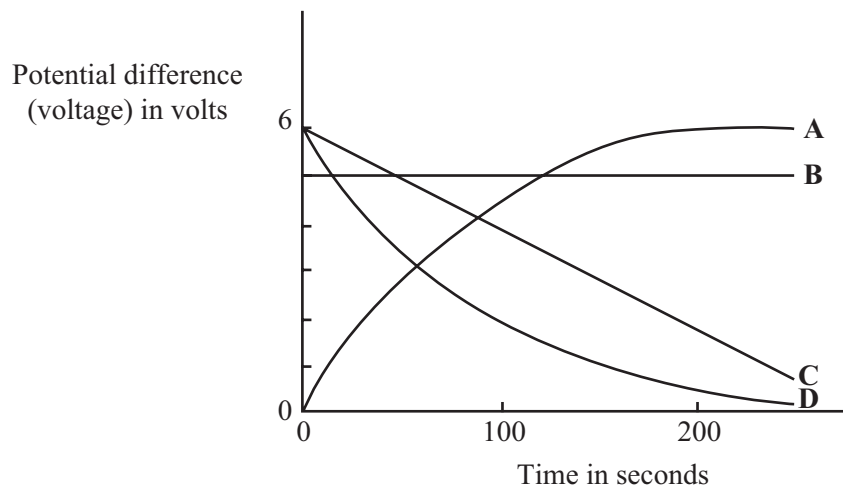
Turn over ►

QUESTION SEVEN

The circuit is used to charge a capacitor.



- 7.1 Which graph line, **A**, **B**, **C** or **D**, shows how the potential difference (voltage) across the capacitor changes as it is being charged?



7.2 The variable resistor is adjusted. It now takes a shorter time to charge the capacitor.

Why is this?

- A** The capacitor stores less charge
- B** The capacitor stores more charge
- C** The resistance has been decreased
- D** The resistance has been increased

7.3 A different capacitor is used. It has a smaller value.

Which statement about the capacitor is correct?

- A** It takes a longer time to charge
- B** It takes a shorter time to charge
- C** The time taken to charge fully is the same
- D** It never fully charges

7.4 Capacitors are used in electronic circuits as

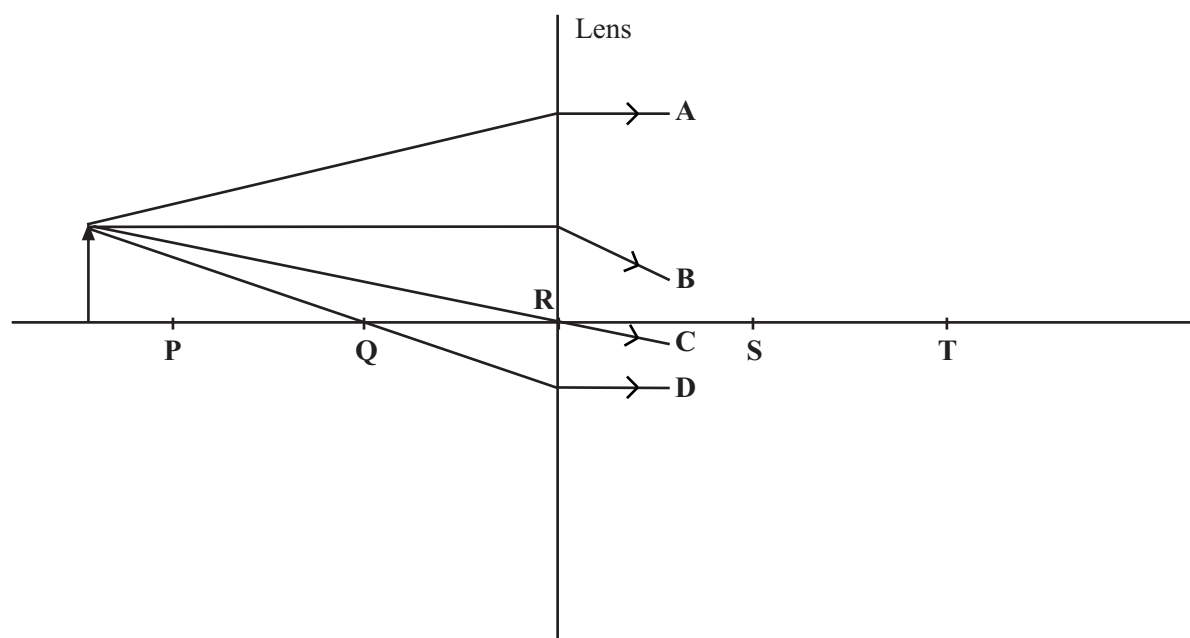
- A** output devices.
- B** processors.
- C** switches.
- D** timers.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION EIGHT

The ray diagram shows how a lens in a camera works.



8.1 Which ray, **A**, **B**, **C** or **D**, is drawn incorrectly?

8.2 What is the image like?

- A It is upright and real
- B It is upright and virtual
- C It is upside down and real
- D It is upside down and virtual

8.3 Which point is the focus?

- A **P**
- B **R**
- C **S**
- D **T**

8.4 Where is the image formed?

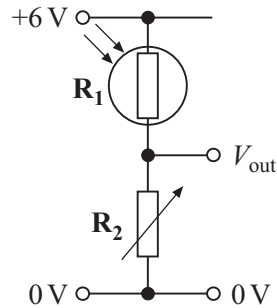
- A** Between **P** and **Q**
- B** Between **Q** and **R**
- C** Between **S** and **T**
- D** Beyond **T**

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The diagram shows part of a circuit which can be used as an automatic switch.



You may find the following formula useful when answering this question.

$$V_{out} = V_{in} \times \frac{R_2}{(R_1 + R_2)}$$

The resistance of R_2 is 2000 ohms.

In daylight, the resistance of R_1 is 500 ohms.

9.1 In daylight, what is the value of V_{out} ?

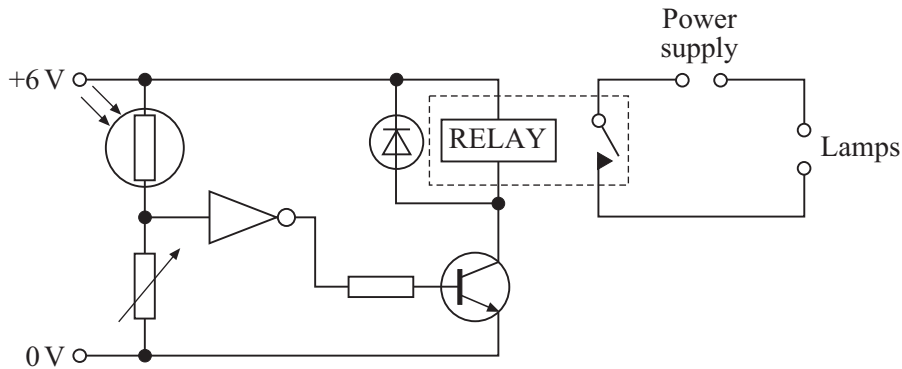
- A 1.2 V
- B 4.8 V
- C 7.5 V
- D 30.0 V

9.2 Resistor R_2 is changed.

What resistance must it have to make the output voltage 1.5 V in daylight?

- A 167 Ω
- B 377 Ω
- C 400 Ω
- D 1500 Ω

The full circuit is shown below.



9.3 In daylight the lamps are off. When it gets dark, the lamps come on.

This is because

- A the resistance of the LDR is large in the dark, making the input to the NOT gate high.
 - B the resistance of the LDR is large in the dark, making the input to the NOT gate low.
 - C the resistance of the LDR is small in the dark, making the input to the NOT gate high.
 - D the resistance of the LDR is small in the dark, making the input to the NOT gate low.
- 9.4 The circuit is to be changed so that a heater switches on when it is cold. The lamps are replaced by the heater.

What further change is needed?

- A The LDR must be replaced by a thermistor
- B The LDR and the variable resistor must change places
- C The LDR must be replaced by a thermistor, and the NOT gate must be removed
- D The LDR and the variable resistor must change places, and the NOT gate must be removed

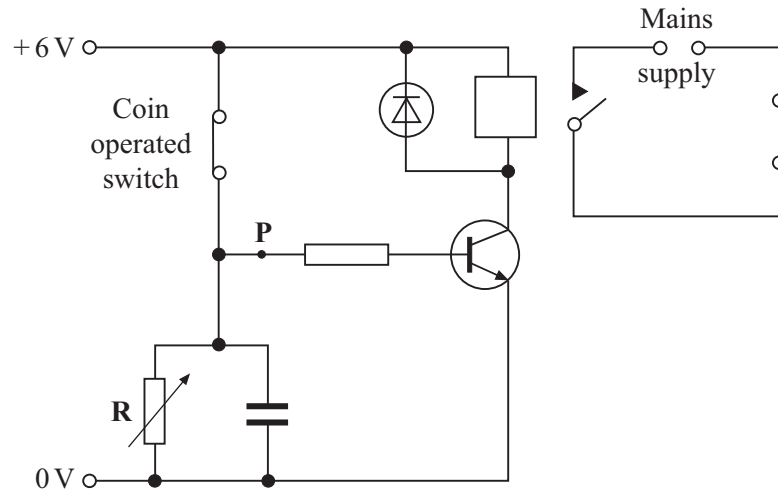
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

A squash court is lit by a set of lamps. When a £1 coin is inserted into a slot, the lamps operate for a set time.

The control circuit is shown below.



- 10.1** The transistor acts as a switch by
- A closing when the input voltage at **P** goes to high.
 - B closing when the input voltage at **P** goes to low.
 - C opening when the relay switch closes.
 - D opening when the input voltage at **P** goes to high.
- 10.2** Why does the relay switch close, making the lights come on?
- A The diode allows a current to flow to the transistor
 - B The transistor switch turns on
 - C The transistor switch turns off
 - D The transistor does not allow a current to flow

10.3 When the coin operated switch is closed, the voltage input at **P** goes to high and so

- A** the capacitor charges up.
- B** the capacitor conducts a current.
- C** the capacitor discharges.
- D** the capacitor releases its stored charge.

10.4 The £1 coin eventually falls into a box, and the coin operated switch opens.

Which row of the table, **A**, **B**, **C** or **D**, best describes what happens next?

	Capacitor	Voltage at P	The lamps
A	charges	rises to 6V slowly	continue to shine for a time
B	discharges	falls to 0V slowly	continue to shine for a time
C	charges	falls to 0V slowly	stop shining immediately
D	discharges	rises to 6V slowly	stop shining immediately

END OF TEST

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