

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education  
November 2006



**PHYSICS (SPECIFICATION A) (MODULAR)**  
**Physics in Action (Module 23)**

**346023**

Thursday 23 November 2006 Morning Session

**For this paper you must have:**

- a black ball-point pen
- an objective test answer sheet

You may use a calculator.

Time allowed: 30 minutes

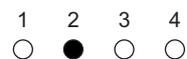
**Instructions**

- 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.
- Do all rough work in this book, **not** on your answer sheet.

**Instructions for recording answers**

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

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



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

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



- 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:



**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 16 of this booklet.

---

**FOUNDATION TIER**

**SECTION A**

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

In these questions, match 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**

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

---

**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**

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

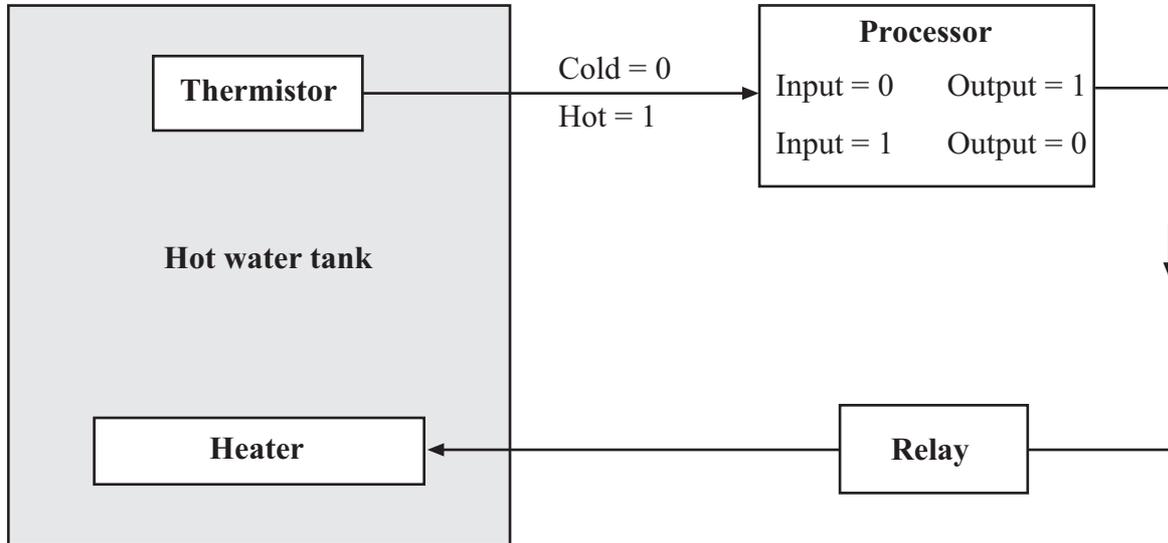
**Turn over for the next question**

**Turn over ►**

**QUESTION THREE**

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

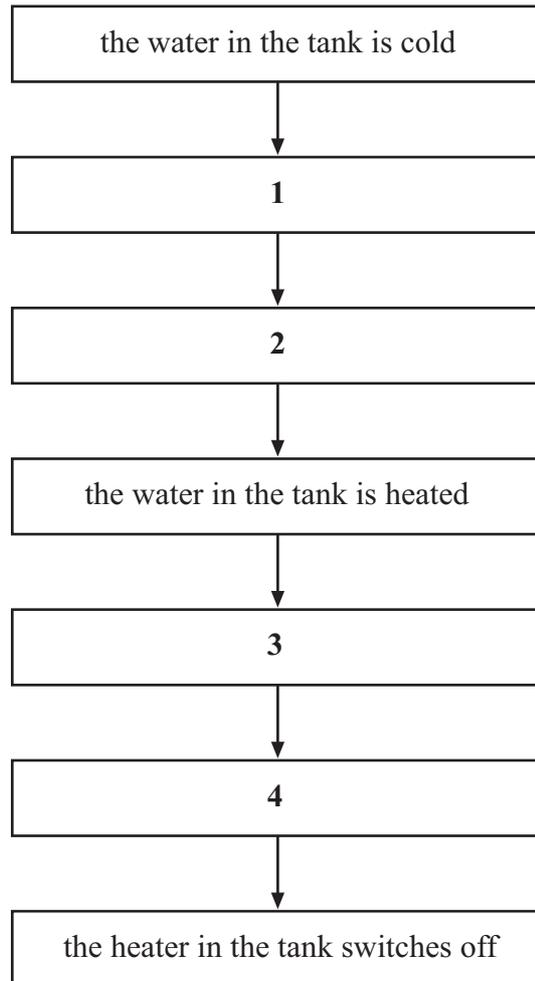
This is shown in the diagram below.



The flow chart on the next page explains how the system works.

Match statements, **P**, **Q**, **R** and **S**, from the list with the numbers **1–4** in the flow chart.

- 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



**Turn over for the next question**

**Turn over ►**

---

**QUESTION FOUR**

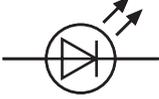
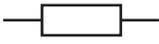
Match names from the list with the numbers **1–4** in the table.

**capacitor**

**LED**

**OR gate**

**resistor**

Symbol	Name
	<b>1</b>
	<b>2</b>
	<b>3</b>
	<b>4</b>

**QUESTION FIVE**

This question is about a relay.

Match words from the list with the numbers **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 current passes through the . . . **3** . . . of the relay.

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

**Turn over for the next question**

**Turn over ►**

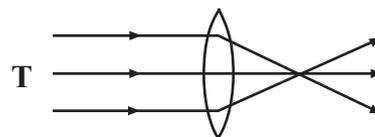
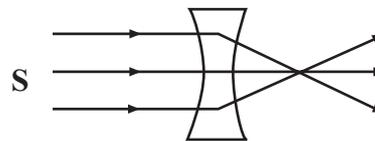
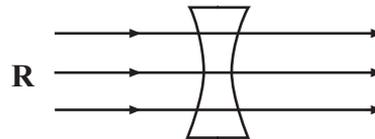
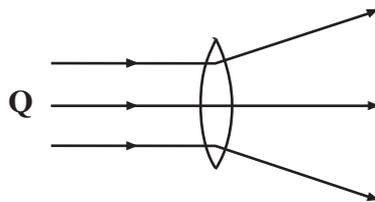
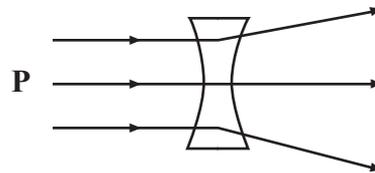
---

**SECTION B**Questions **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** diagrams, **P**, **Q**, **R**, **S** and **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** statements about a camera are **incorrect**?

**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 nearer to the lens than the object**

**the image is smaller than the object**

**Turn over for the next question**

**Turn over ►**

---

**SECTION C**Questions **EIGHT** to **TEN**.

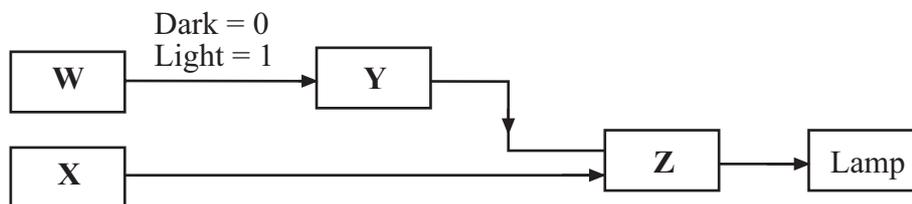
Each of these questions has four parts.

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 by hand at any time.

**8.1** X is . . .

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

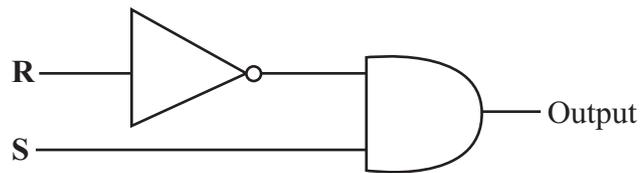
**8.2** Y is . . .

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

8.3 Z is . . .

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

8.4 The diagram shows a processor with two logic gates combined.



Which row of the truth table is **incorrect** for this processor?

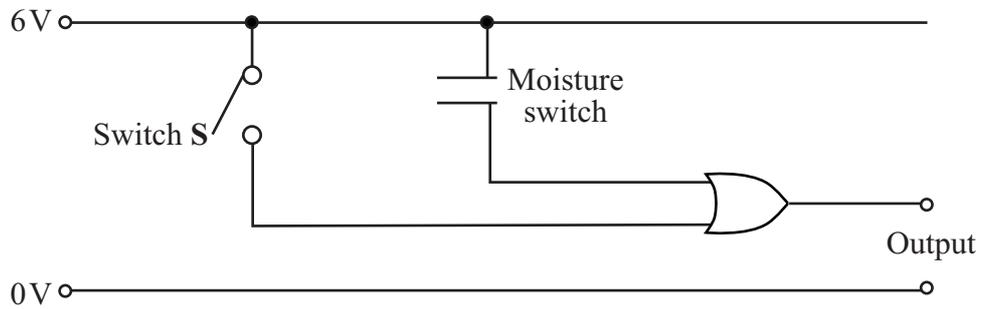
	Input R	Input S	Output
A	0	0	0
B	0	1	0
C	1	0	0
D	1	1	0

**Turn over for the next question**

**Turn over ►**

**QUESTION NINE**

A car uses an 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?

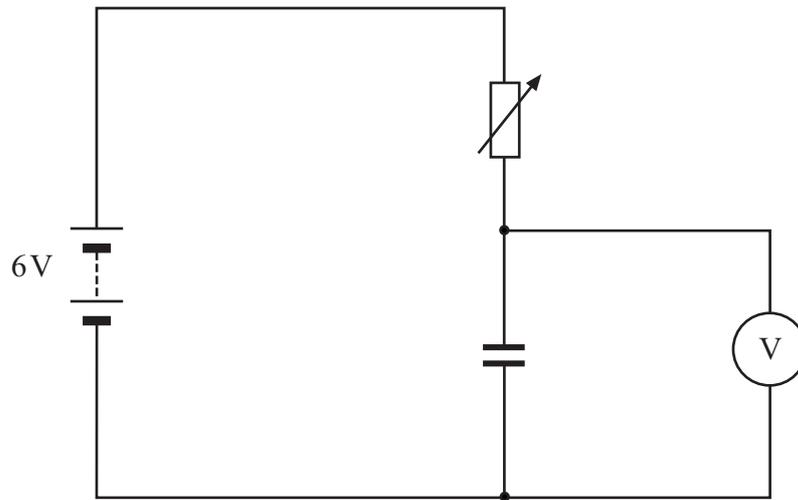
- A A motor
- B A relay
- C A thermistor
- D A transistor

**Turn over for the next question**

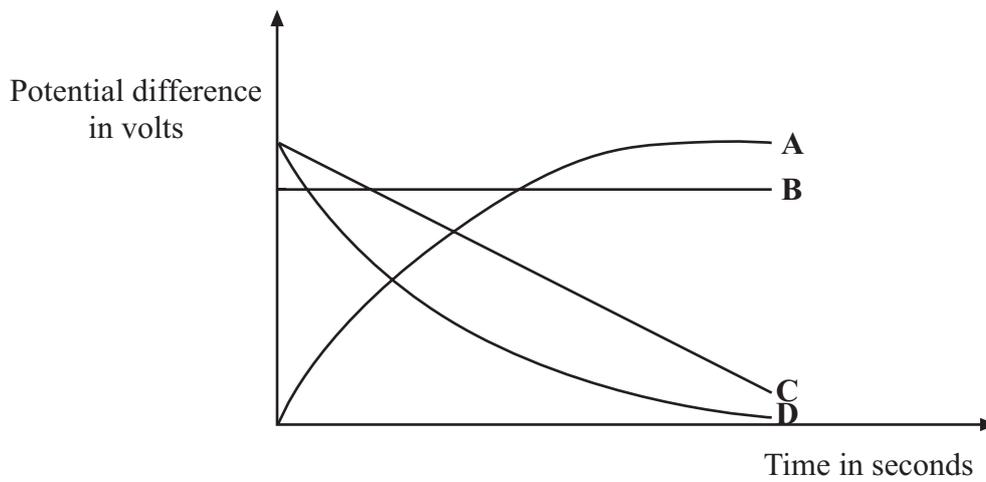
**Turn over ►**

**QUESTION TEN**

The circuit is used to charge a capacitor.



**10.1** Which graph line shows the change in potential difference across the capacitor 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 new capacitor is correct?

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

**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 is earlier in this booklet.

---

## HIGHER TIER

### SECTION A

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

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

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

Mark your choices on the answer sheet.

---

### QUESTION ONE

This question is about a relay.

Match words from the list with the numbers **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 current passes through the . . . **3** . . . of the relay.

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

**QUESTION TWO**

The diagram shows a fire alarm circuit.

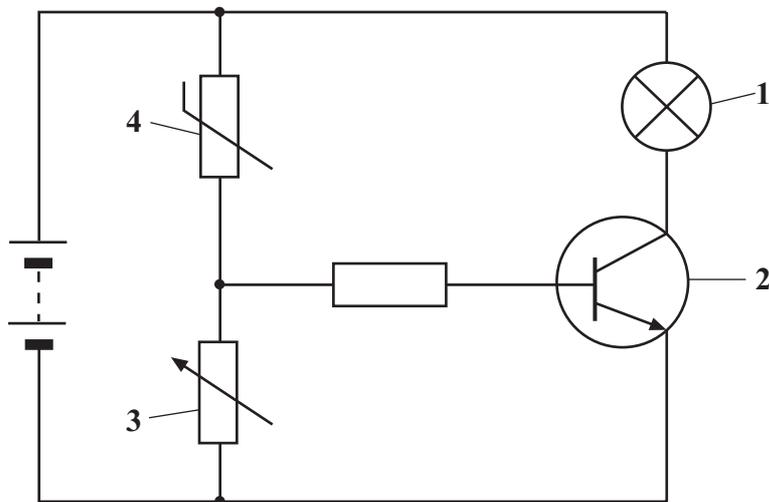
Match words from the list with the components 1–4 in the circuit.

**acts as a switch**

**controls the sensitivity of the circuit**

**input sensor**

**output device**



**Turn over for the next question**

**Turn over ►**

---

**SECTION B**Questions **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** statements about a camera are **incorrect**?

- 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 nearer to the lens than the object**
- the image is smaller than the object**

**QUESTION FOUR**

More than eighty percent of the teenage and adult population of the UK now use mobile phones.

Which **two** statements are disadvantages of mobile phones?

- their batteries often need charging**
- their batteries often need replacing**
- they are always very expensive to use**
- they can be used only for distances of less than 500 km**
- they may distract drivers**

**Turn over for the next question**

**Turn over ►**

---

**SECTION C**Questions **FIVE** to **TEN**.

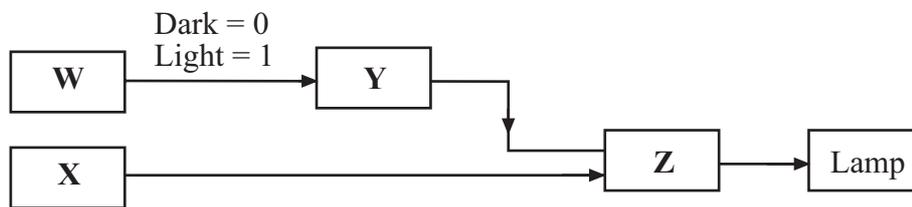
Each of these questions has four parts.

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 by hand at any time.

**5.1** X is . . .

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

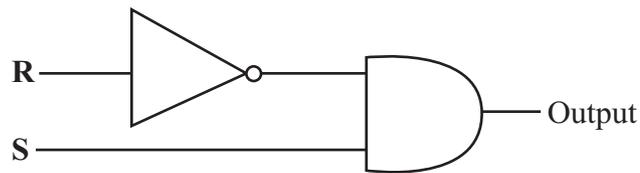
**5.2** Y is . . .

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

5.3 Z is . . .

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

5.4 The diagram shows a processor with two logic gates combined.



Which row of the truth table is **incorrect** for this processor?

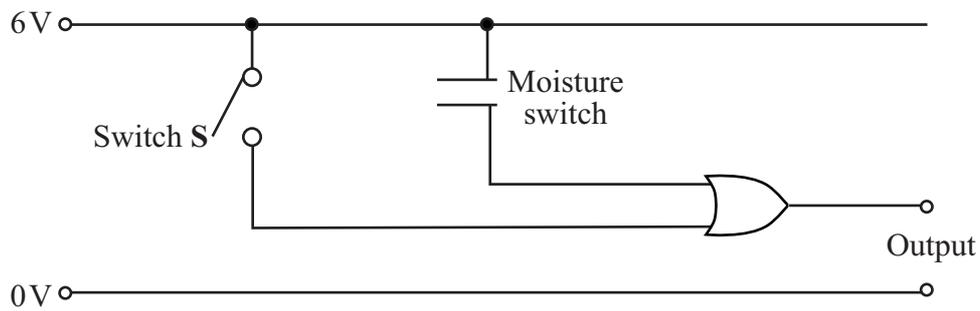
	Input R	Input S	Output
A	0	0	0
B	0	1	0
C	1	0	0
D	1	1	0

**Turn over for the next question**

**Turn over ►**

**QUESTION SIX**

A car uses an 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?

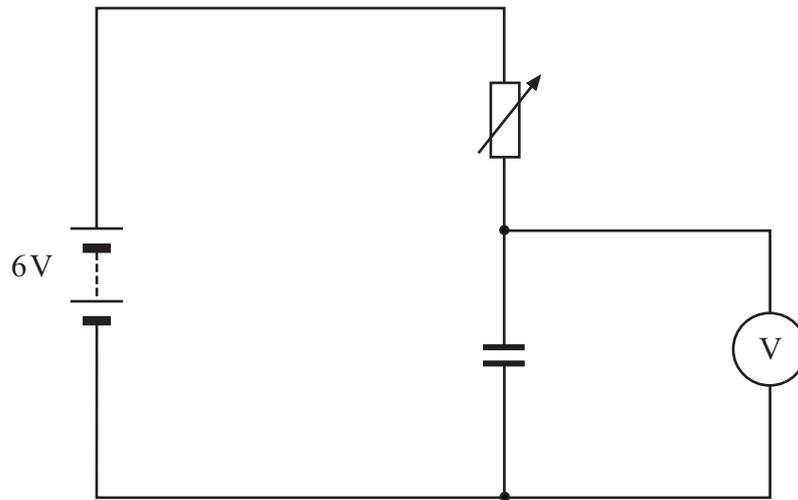
- A A motor
- B A relay
- C A thermistor
- D A transistor

**Turn over for the next question**

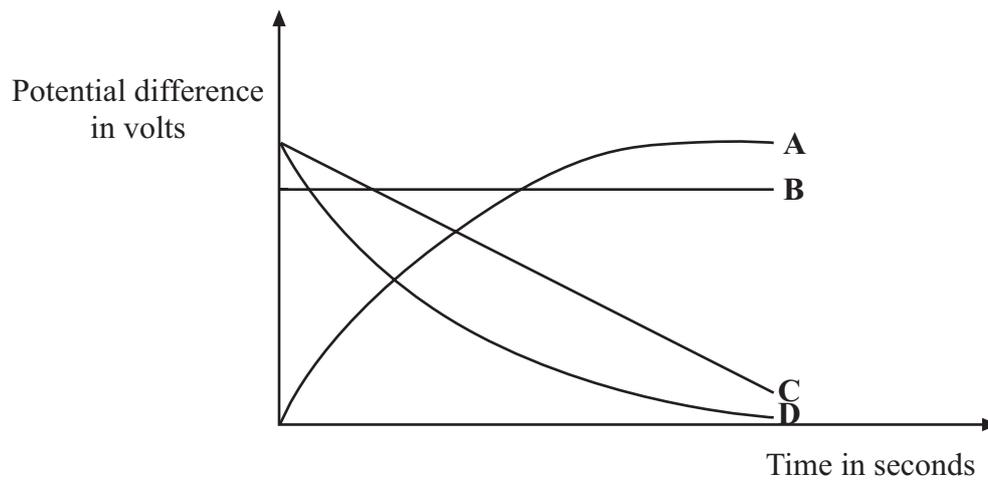
**Turn over ►**

**QUESTION SEVEN**

The circuit is used to charge a capacitor.



- 7.1 Which graph line shows the change in potential difference across the capacitor 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 new capacitor is correct?

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

**7.4** Capacitors are used in electronic circuits as . . .

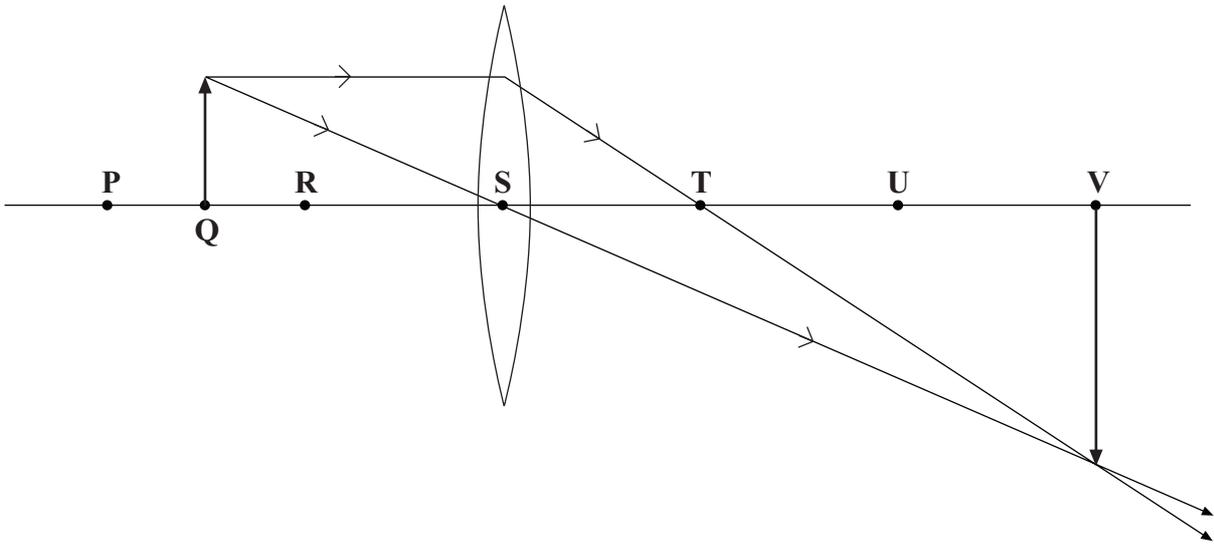
- A** output devices.
- B** processors.
- C** switches.
- D** timers.

**Turn over for the next question**

**Turn over ►**

**QUESTION EIGHT**

The ray diagram shows how an image can be formed by a lens.



**8.1** The image is formed at . . .

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

**8.2** The focus of the lens is at . . .

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

**8.3** Which row in the table correctly describes this lens and image?

	<b>Lens</b>	<b>Image</b>
<b>A</b>	converging	erect
<b>B</b>	converging	inverted
<b>C</b>	diverging	erect
<b>D</b>	diverging	inverted

**8.4** The object is now placed between **R** and **S**.

Which row in the table is correct?

	<b>Object</b>	<b>Image</b>
<b>A</b>	real	real
<b>B</b>	real	virtual
<b>C</b>	virtual	real
<b>D</b>	virtual	virtual

**Turn over for the next question**

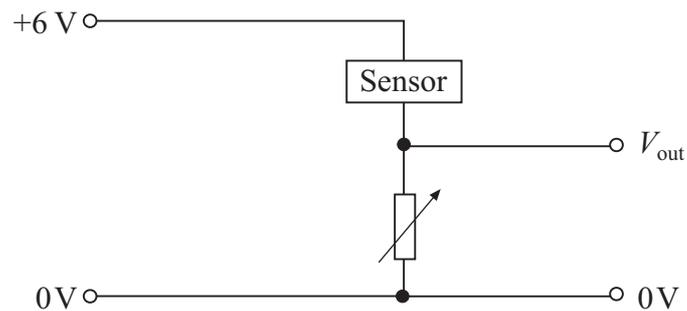
**Turn over ►**

**QUESTION NINE**

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

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

The arrangement shown has its variable resistor set to  $2000 \Omega$ .  
The sensor resistance varies with changes in the environment.  
At the start, the sensor resistance was  $1000 \Omega$ .



**9.1** At the start, what was the potential difference  $V_{\text{out}}$ ?

- A 1 V
- B 2 V
- C 3 V
- D 4 V

**9.2** What was the potential difference across the sensor?

- A 1 V
- B 2 V
- C 3 V
- D 4 V

**9.3** The environmental conditions change, and the value of  $V_{\text{out}}$  becomes 3 V.

What is the new value of the sensor resistor?

- A 1000  $\Omega$
- B 1333  $\Omega$
- C 2000  $\Omega$
- D 4000  $\Omega$

**9.4** The sensor resistance becomes 1500  $\Omega$ .

What value must the variable resistor be changed to so that the value of  $V_{\text{out}}$  is 1.5 V?

- A 250  $\Omega$
- B 333  $\Omega$
- C 500  $\Omega$
- D 667  $\Omega$

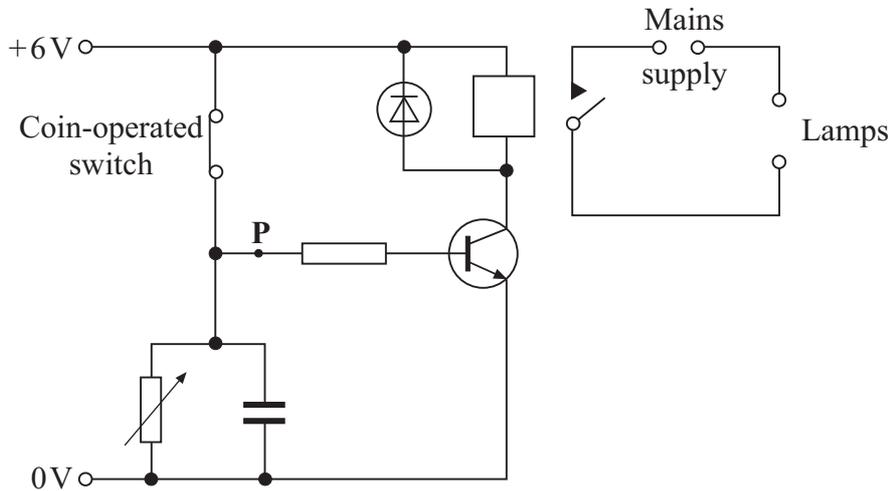
**Turn over for the next question**

**Turn over ►**

**QUESTION TEN**

A squash court is lit by a set of lamps. When a £2 coin is inserted into a slot, the lamps operate for thirty minutes.

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 input voltage at **P** goes to high.
- D** opening when the relay switch closes.

**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 does not allow a current to flow.
- C** The transistor switch turns off.
- D** The transistor switch turns on.

---

**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 £2 coin eventually falls into a box, and the coin-operated switch opens.

Which row in the table best describes what happens next?

	<b>Capacitor</b>	<b>Voltage at P</b>	<b>The lamps</b>
<b>A</b>	charges	falls to 0 V slowly	go off immediately
<b>B</b>	charges	rises to 6 V slowly	go off immediately
<b>C</b>	discharges	falls to 0 V slowly	stay on for a time
<b>D</b>	discharges	rises to 6 V slowly	stay on for a time

**END OF TEST**

**There are no questions printed on this page**