

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
June 2005



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

346023

Tuesday 28 June 2005 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 16 of this booklet.

FOUNDATION TIER

SECTION A

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

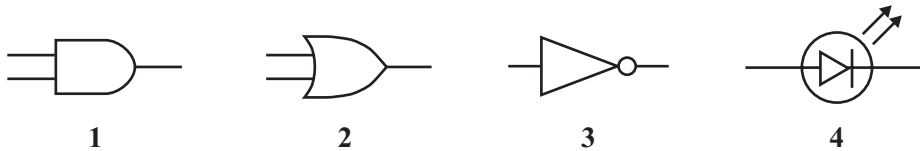
In these questions match the words in the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

The circuit symbols shown are used in electronic circuit diagrams.



Match words from the list with the symbols **1–4**.

AND gate

LED

NOT gate

OR gate

QUESTION TWO

In electronic circuits, components have different functions.

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

AND gate

LDR

LED

NOT gate

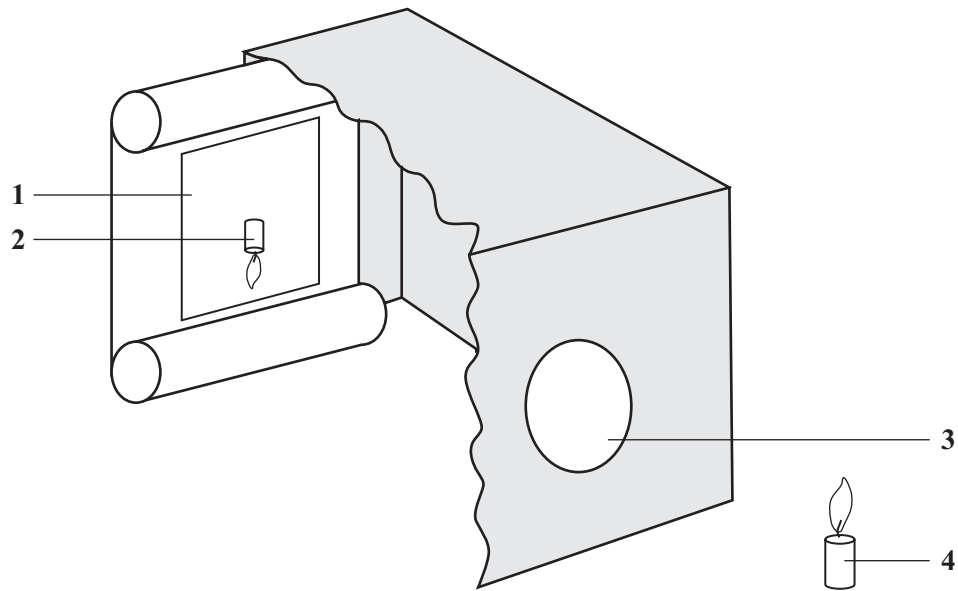
Component	Function
1	an input sensor
2	an output device
3	a processor with one input
4	a processor with two inputs

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION THREE

The diagram shows part of a simple camera.



Match words from the list with the numbers 1–4 on the diagram.

film

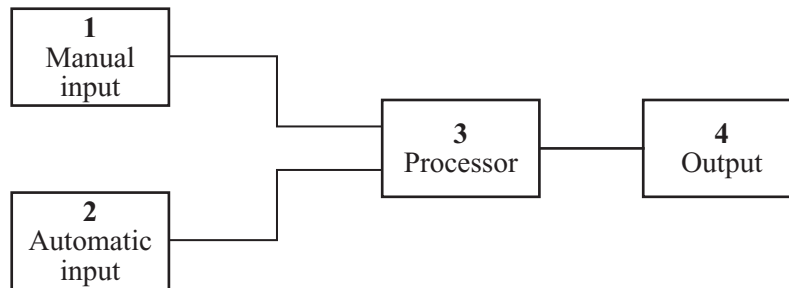
image

lens

object

QUESTION FOUR

The diagram shows an electronic control system for a machine.
The system needs two inputs.
One is a manual input controlled by the machine operator.
The other is an automatic input which depends on the conditions.



Match words from the list with the numbers 1–4 on the diagram.

AND gate

motor

switch

thermistor

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION FIVE

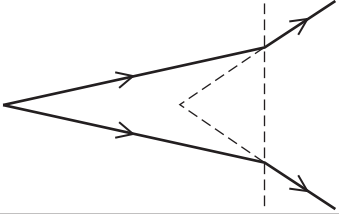
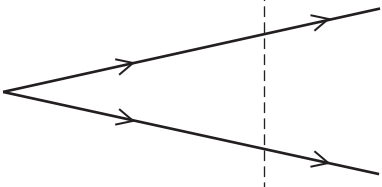
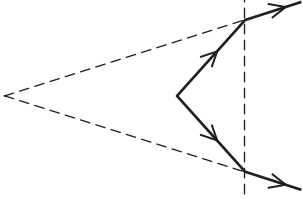
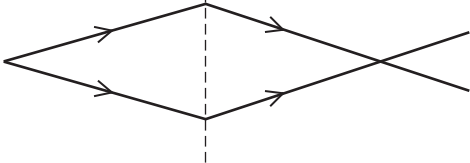
Match the descriptions in the list with the numbers 1–4 in the table.

a converging lens making a real image

a converging lens making a virtual image

a diverging lens making a virtual image

a thin piece of flat glass making no image

1	
2	
3	
4	

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

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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

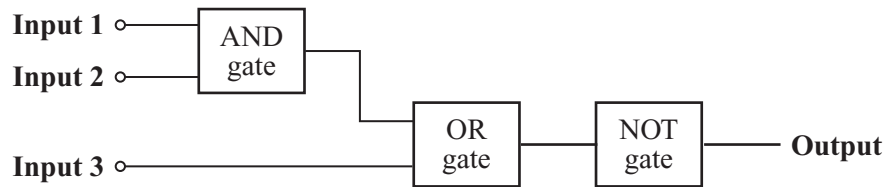
Many electronic circuits contain capacitors.

Which **two** of the following statements **J**, **K**, **L**, **M** and **N** about capacitors are correct?

- J** capacitors can store electric charge
- K** if you connect a wire across the ends of a charged capacitor, the charge increases very quickly
- L** increasing the resistance of the charging circuit increases the time taken to charge a capacitor
- M** one use of a capacitor is to convert inputs to outputs
- N** the greater the value of the capacitor, the shorter the time it takes to discharge

QUESTION SEVEN

The diagram shows part of an electronic control system.



Which **two** rows **P**, **Q**, **R**, **S** and **T** of the truth table are correct for this system?

	Input 1	Input 2	Input 3	Output
P	0	0	0	1
Q	0	0	1	1
R	0	1	0	1
S	1	1	0	1
T	1	1	1	1

TURN OVER FOR THE NEXT QUESTION

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

Each of these questions has four parts.

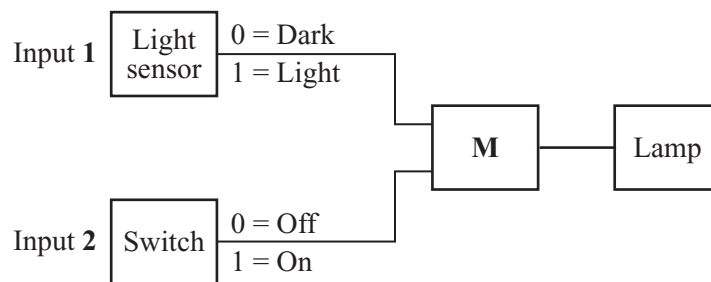
In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION EIGHT

A man wanted a light to come on when it got dark.

He also wanted to be able to switch the light on at any time.

He drew this block diagram of the electronic control system he would use.

**8.1** Which of these statements describes **M** and the lamp?

- A** **M** is the input device and the lamp is the output device
- B** **M** is the input device and the lamp is the processor
- C** **M** is the processor and the lamp is the input device
- D** **M** is the processor and the lamp is the output device

8.2 Which of these is the truth table for the electronic control system the man needs?

A

Input 1	Input 2	Output
0	0	1
0	1	1
1	0	0
1	1	1

B

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	1

C

Input 1	Input 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

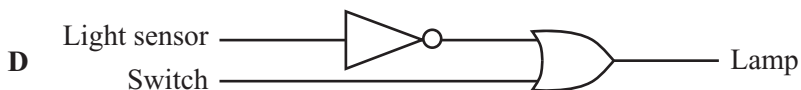
D

Input 1	Input 2	Output
0	0	1
0	1	0
1	0	0
1	1	1

8.3 Which device can be used in the light sensor?

- A LDR
- B LED
- C Relay
- D Thermistor

8.4 Which of these processors produces the correct output for the man's control system?



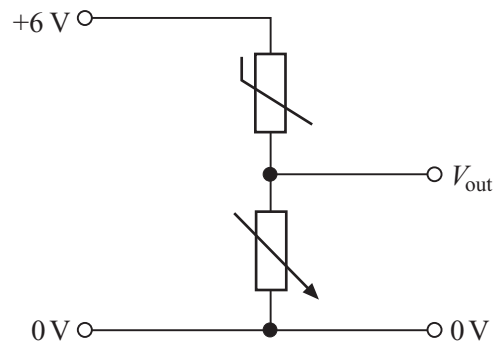
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QUESTION NINE

You may find this formula useful when answering parts of this question.

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

This arrangement is often used in electronic control systems.



9.1 The arrangement is called a

- A buffer.
- B potential divider.
- C relay.
- D transformer.

9.2 The arrangement can be used as

- A a heat sensor.
- B a light sensor.
- C a timer.
- D an output device.

- 9.3** The value of the variable resistor is $2\text{ k}\Omega$.
In certain conditions, the resistance of the other component is $1\text{ k}\Omega$.

What is the value of the output (V_{out}) in these conditions?

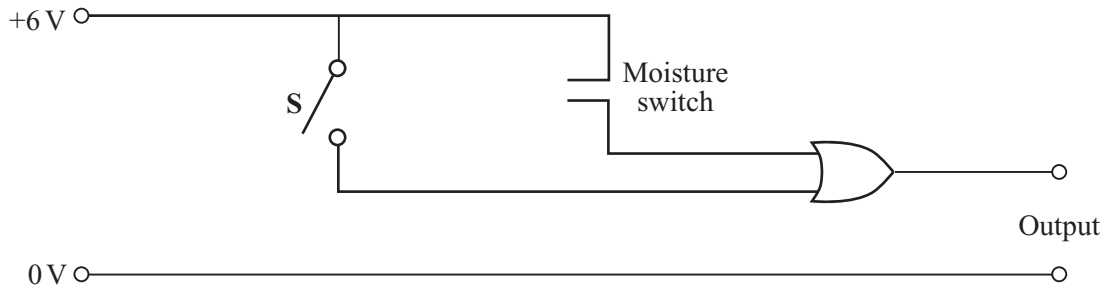
- A Zero
 - B 2 V
 - C 4 V
 - D 6 V
- 9.4** In an electronic control system, the output voltage (V_{out}) is fed to the
- A input sensor.
 - B output device.
 - C processor.
 - D variable resistor.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

A market stallholder wants an electronic control system which will close some shutters when it starts to rain. She also wants to be able to close the shutters herself by using a switch. She uses the system below.



10.1 The logic gate in the system is the

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

10.2 The moisture switch closes when rain falls on it.

When do the shutters close?

- A Only when switch S is closed
- B Only when the moisture switch is closed
- C When either switch is closed
- D Only when both switches are closed

10.3 What output device will be needed?

- A Buzzer
- B Heater
- C LED
- D Motor

10.4 The output device needs a large current. The system shown in the diagram cannot provide a large current.

What must be added to the system?

- A A diode
- B A potential divider
- C A relay
- D A transformer

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

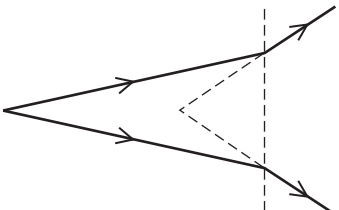
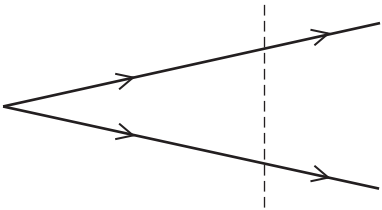
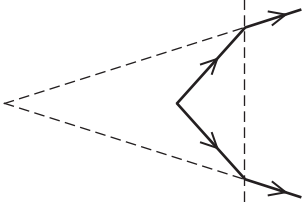
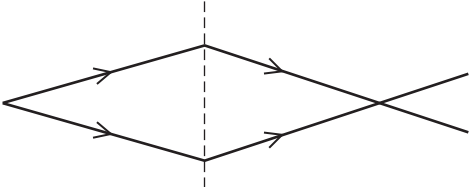
Match the descriptions in the list with the numbers **1–4** in the table.

a converging lens making a real image

a converging lens making a virtual image

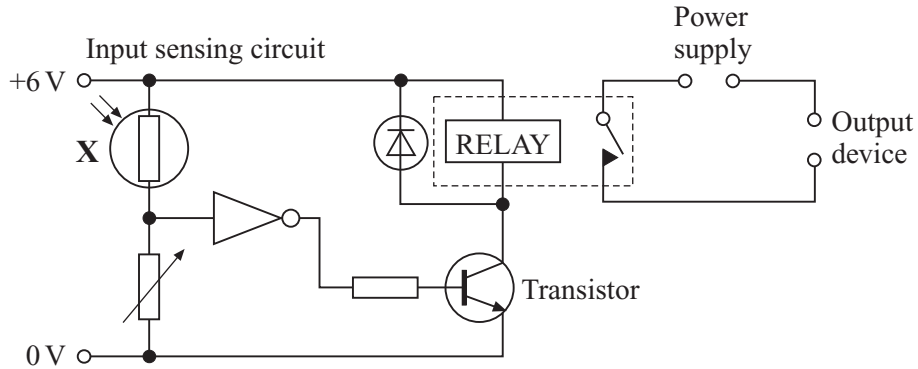
a diverging lens making a virtual image

a thin piece of flat glass making no image

1	
2	
3	
4	

QUESTION TWO

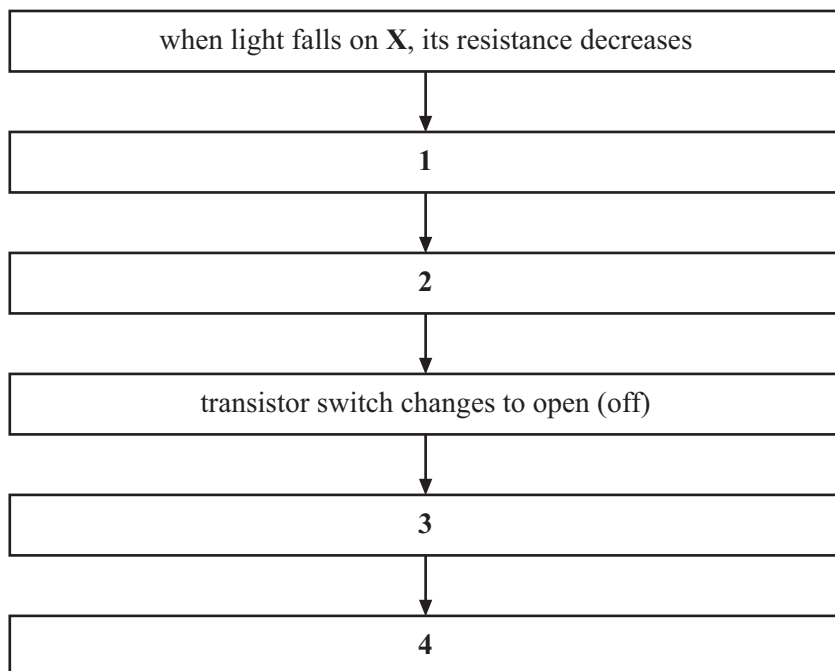
The diagram shows an electronic control system.



The flow diagram explains how the system works.

Match statements **D**, **E**, **F** and **G** from the list with boxes **1–4**.

- D** current through the relay is switched off
- E** output from the NOT gate becomes low
- F** relay switches off the power supply to the output device
- G** voltage across the variable resistor increases



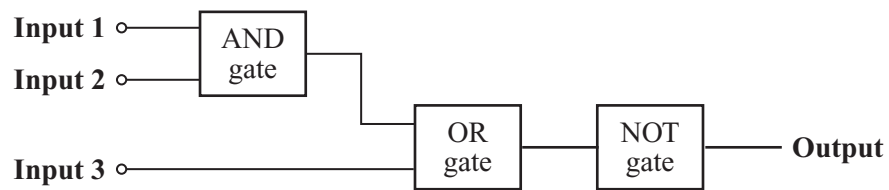
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SECTION BQuestions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

The diagram shows part of an electronic control system.

Which **two** rows **P**, **Q**, **R**, **S** and **T** of the truth table are correct for this system?

	Input 1	Input 2	Input 3	Output
P	0	0	0	1
Q	0	0	1	1
R	0	1	0	1
S	1	1	0	1
T	1	1	1	1

QUESTION FOUR

Using electronic systems has some advantages and some disadvantages.

Which **two** of the statements **J**, **K**, **L**, **M** and **N** give advantages of using electronic systems?

- J** CCTV results in loss of privacy
- K** mobile phones enable businesses to keep in touch with staff all over the world
- L** much valuable information can be obtained on the Internet
- M** some people think that mobile phone masts pose a health hazard
- N** the accuracy of some information on the Internet is uncertain

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.

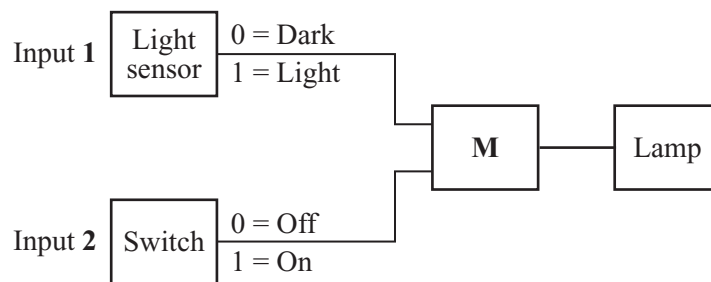
Mark your choices on the answer sheet.

QUESTION FIVE

A man wanted a light to come on when it got dark.

He also wanted to be able to switch the light on at any time.

He drew this block diagram of the electronic control system he would use.

**5.1** Which of these statements describes **M** and the lamp?

- A** **M** is the input device and the lamp is the output device
- B** **M** is the input device and the lamp is the processor
- C** **M** is the processor and the lamp is the input device
- D** **M** is the processor and the lamp is the output device

5.2 Which of these is the truth table for the electronic control system the man needs?

A

Input 1	Input 2	Output
0	0	1
0	1	1
1	0	0
1	1	1

B

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	1

C

Input 1	Input 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

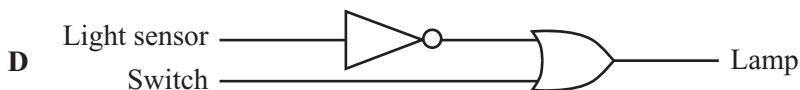
D

Input 1	Input 2	Output
0	0	1
0	1	0
1	0	0
1	1	1

5.3 Which device can be used in the light sensor?

- A LDR
- B LED
- C Relay
- D Thermistor

5.4 Which of these processors produces the correct output for the man's control system?



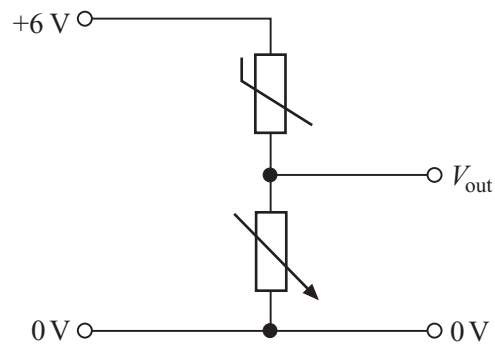
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QUESTION SIX

You may find this formula useful when answering parts of this question.

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

This arrangement is often used in electronic control systems.



- 6.1 The arrangement is called a
- A buffer.
 - B potential divider.
 - C relay.
 - D transformer.
- 6.2 The arrangement can be used as
- A a heat sensor.
 - B a light sensor.
 - C a timer.
 - D an output device.

- 6.3** The value of the variable resistor is $2\text{ k}\Omega$.
In certain conditions, the resistance of the other component is $1\text{ k}\Omega$.

What is the value of the output (V_{out}) in these conditions?

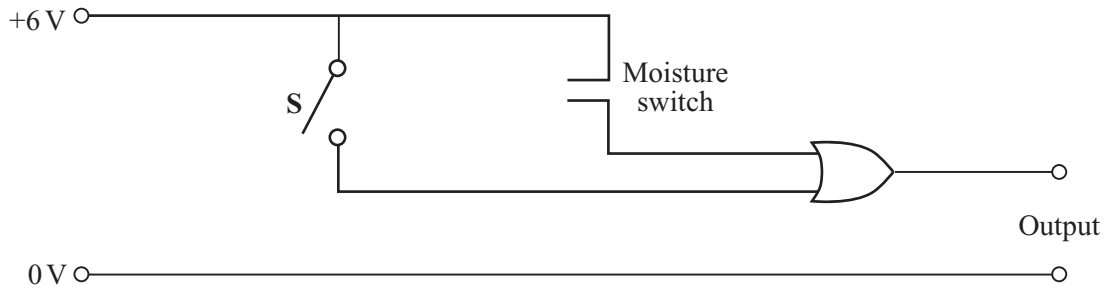
- A Zero
 - B 2 V
 - C 4 V
 - D 6 V
- 6.4** In an electronic control system, the output voltage (V_{out}) is fed to the
- A input sensor.
 - B output device.
 - C processor.
 - D variable resistor.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SEVEN

A market stallholder wants an electronic control system which will close some shutters when it starts to rain. She also wants to be able to close the shutters herself by using a switch. She uses the system below.



7.1 The logic gate in the system is the

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

7.2 The moisture switch closes when rain falls on it.

When do the shutters close?

- A Only when switch S is closed
- B Only when the moisture switch is closed
- C When either switch is closed
- D Only when both switches are closed

7.3 What output device will be needed?

- A Buzzer
- B Heater
- C LED
- D Motor

7.4 The output device needs a large current. The system shown in the diagram cannot provide a large current.

What must be added to the system?

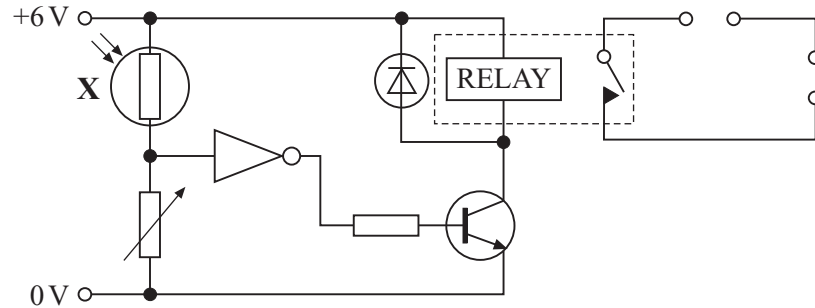
- A** A diode
- B** A potential divider
- C** A relay
- D** A transformer

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION EIGHT

The diagram shows part of an electronic system.



- 8.1** What is component **X**?
- A A capacitor
 - B A lamp
 - C An LDR
 - D An LED
- 8.2** The input to the NOT gate is
- A less than 0 volts.
 - B exactly 0 volts.
 - C between 0 and 6 volts.
 - D greater than 6 volts.
- 8.3** The purpose of the diode is to
- A keep a high current in the circuit.
 - B keep the relay working.
 - C protect the relay.
 - D protect the transistor.

8.4 Which of the following happens when the resistance of the variable resistor is increased?

- A** A brighter light is needed to operate the relay
- B** Less light is needed to operate the relay
- C** The relay operates more quickly
- D** The relay takes longer to operate

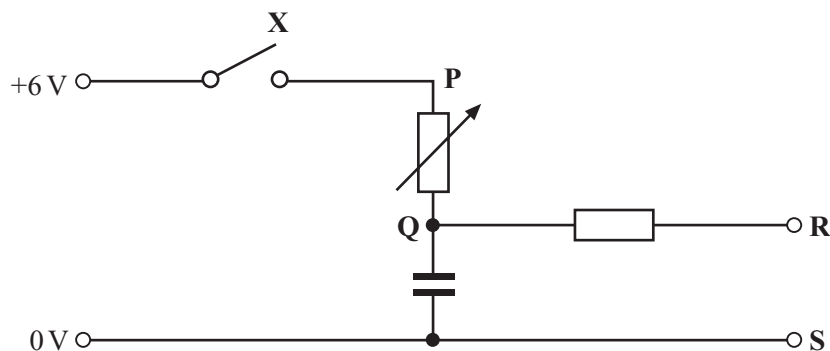
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The diagram shows part of an electronic timer.

When the potential difference (voltage) between points **R** and **S** reaches a certain value, a lamp is switched on.



- 9.1** When the switch **X** is closed, the potential difference across the capacitor
- A decreases gradually.
 - B stays the same.
 - C increases gradually.
 - D increases instantly to 6 V.
- 9.2** Which two points would you connect together to discharge the capacitor quickly?
- A P and Q
 - B P and R
 - C Q and R
 - D Q and S
- 9.3** Increasing the resistance of the variable resistor
- A decreases the brightness of the lamp.
 - B decreases the time it takes for the lamp to switch on.
 - C increases the brightness of the lamp.
 - D increases the time it takes for the lamp to switch on.

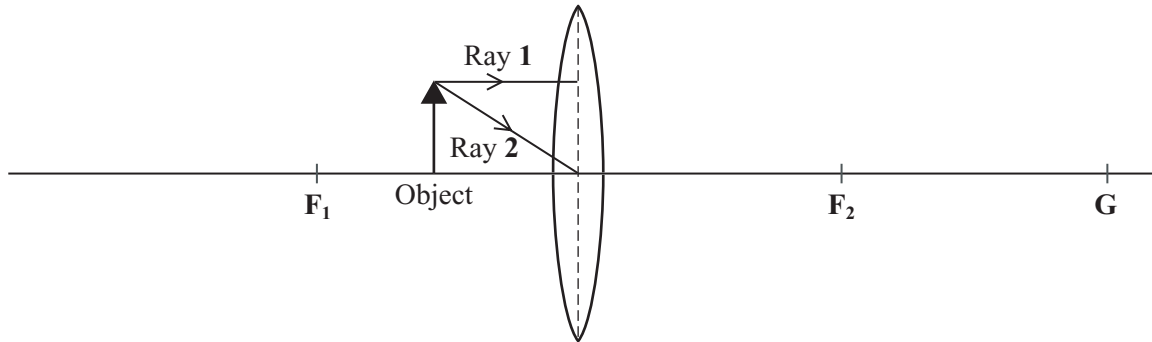
- 9.4** Increasing the value of the capacitor
- A** decreases the brightness of the lamp.
 - B** decreases the time it takes for the lamp to switch on.
 - C** increases the brightness of the lamp.
 - D** increases the time it takes for the lamp to switch on.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

An incomplete ray diagram is shown below.
The points marked F_1 and F_2 are the foci of the lens.



- 10.1** Ray 1 emerges from the lens and
- A diverges from the axis as though it came from F_1 .
 - B passes through F_2 .
 - C passes through G .
 - D travels straight on parallel to the axis.
- 10.2** Ray 2 emerges from the lens and
- A passes along the axis through F_1 .
 - B passes along the axis through F_2 .
 - C travels back along the same path but in the opposite direction.
 - D travels straight on without changing direction.
- 10.3** The image formed is
- A diminished and to the left of the lens.
 - B diminished and to the right of the lens.
 - C magnified and to the left of the lens.
 - D magnified and to the right of the lens.

10.4 The ray diagram shows how a

- A** camera forms a real image.
- B** camera forms a virtual image.
- C** magnifying glass forms a real image.
- D** magnifying glass forms a virtual image.

END OF TEST

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE