

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Winter 2005



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

346023

Thursday 24 November 2005 Morning Session

In addition to this paper you will require:

- a black 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

The diagram shows a simple electronic system. A small current from the processor is used to switch on a large current to the output device.



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

input sensor

output device

processor

relay

QUESTION TWO

Lenses form images of objects.

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

converging

diverging

real

virtual



This is a **1** lens.

It can be used in a camera to form a **2** image.



This is a **3** lens.

It cannot be used in a camera because it always forms **4** images.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION THREE

An electronic system is used to switch on street lighting.

The input sensor is an LDR. It gives an output of **1** in daylight but an output of **0** at night.

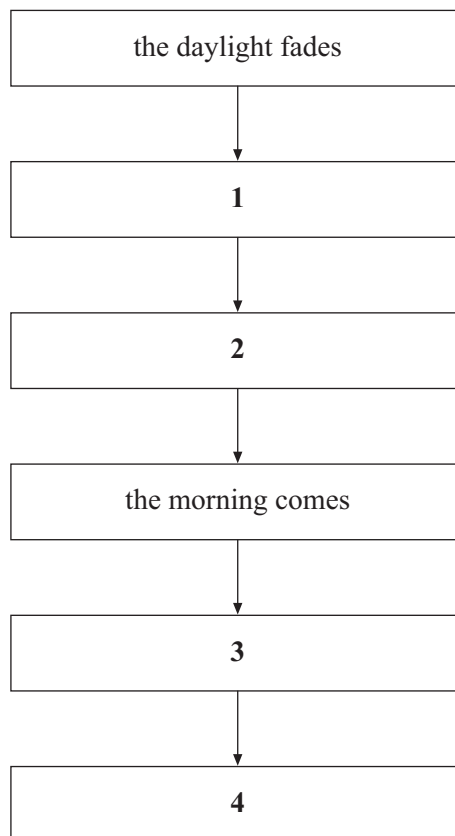
Match statements from the list with the numbers **1–4** on the flow chart.

the LDR gives a high output

the LDR gives a low output

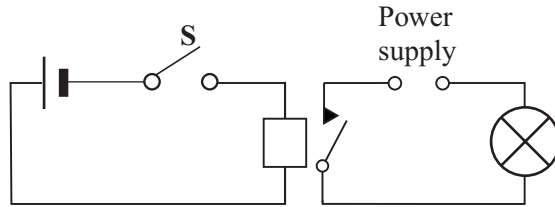
the street lights switch off

the street lights switch on



QUESTION FOUR

The diagram shows a circuit containing a relay.



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

coil

lamp

relay

switch

When the switch **S** is closed, the relay acts as a **1**

A small current flows through the **2** in the relay.

This closes the contact in the **3**

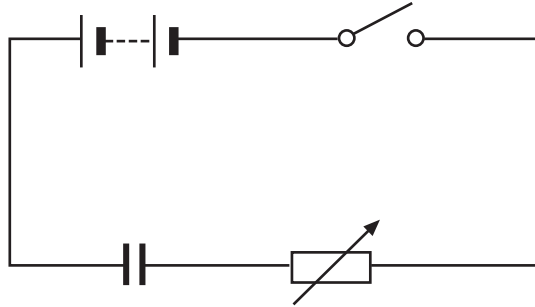
Now a large current can flow through the **4**

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION FIVE

This circuit contains a capacitor.



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

charge

current

potential difference

resistance

The capacitor stores **1**

When the switch is closed, a **2** flows in the circuit.

The **3** across the capacitor increases.

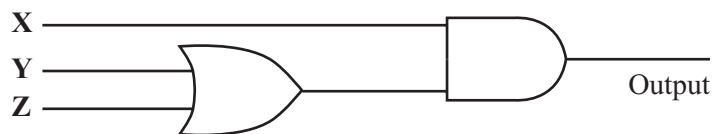
If the **4** of the circuit is increased, the capacitor will take longer to be fully energised.

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 SIXWhich **two** of the following could be used as output devices in an electronic system?**AND gate****LDR****LED****motor****thermistor****QUESTION SEVEN**

The arrangement shown uses two logic gates.

Which **two** of the rows **G**, **H**, **J**, **K** and **L** in the truth table are correct for this arrangement?

	Input X	Input Y	Input Z	Output
G	0	0	0	0
H	0	0	1	1
J	1	0	1	1
K	1	1	0	0
L	1	1	1	0

Turn over ►

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

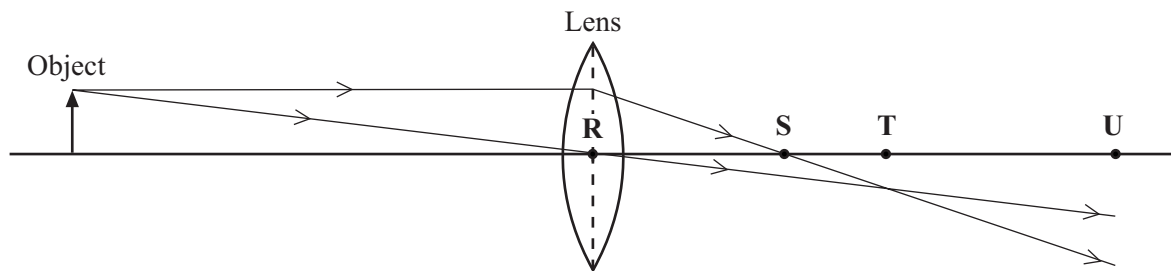
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION EIGHT

The diagram shows a lens being used to produce an image of an object.

**8.1** The focus of the lens is at

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

8.2 The image is formed at

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

8.3 Compared to the object, the image is

- A real and magnified.
- B real and smaller.
- C virtual and magnified.
- D virtual and smaller.

8.4 The system shown could be used in a

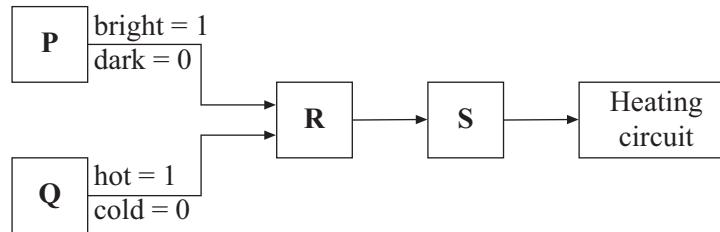
- A camera.
- B magnifying glass.
- C slide projector.
- D telescope.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

A gardener wants a heating system to come on if it is both dark **and** cold in her greenhouse.



9.1 For **P** she could use

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

9.2 For **Q** she could use

- A a heater.
- B an OR gate.
- C a relay.
- D a thermistor.

9.3 For **R** she could use

- A an AND gate.
- B an OR gate.
- C a relay.
- D a thermistor.

9.4 For **S** she could use

- A** an AND gate.
- B** a NOT gate.
- C** a relay.
- D** a thermistor.

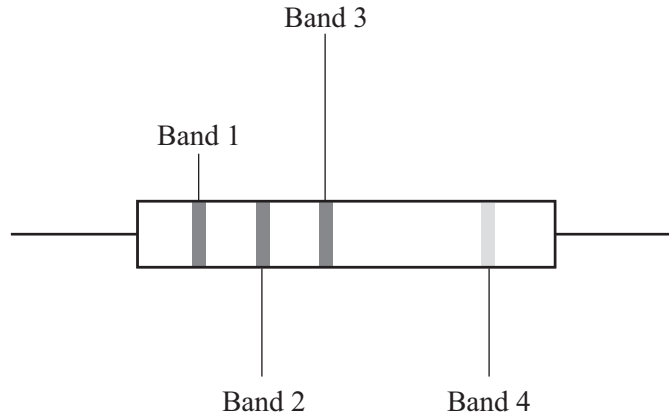
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

The colour code for resistors is shown in the table.

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



10.1 A resistor has the following code:

Band 1	Band 2	Band 3
orange	yellow	red

What is its resistance?

- A** 243 Ω
- B** 342 Ω
- C** 3 400 Ω
- D** 24 000 Ω

10.2 What are the colour bands on a 72 Ω resistor?

	Band 1	Band 2	Band 3
A	black	red	violet
B	black	violet	red
C	violet	red	black
D	violet	red	brown

10.3 What information does Band 4 give about the resistor?

- A Accuracy of the value
- B Diameter
- C Temperature range
- D Year of production

10.4 An LDR does not have a colour code on it.

This is because

- A it has a resistance which is too high for the code.
- B it has a resistance which is too low for the code.
- C it has a varying resistance.
- D it is an input sensor.

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**.

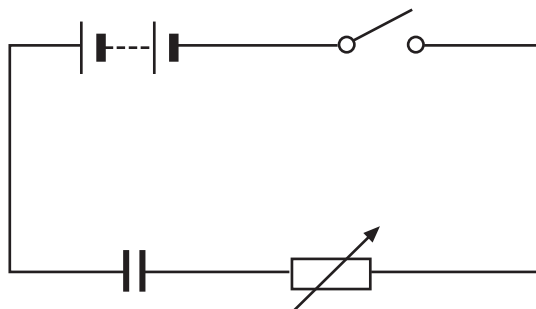
In these questions match the words in the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

This circuit contains a capacitor.



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

charge

current

potential difference

resistance

The capacitor stores **1**

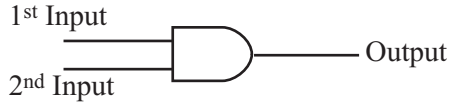
When the switch is closed, a **2** flows in the circuit.

The **3** across the capacitor increases.

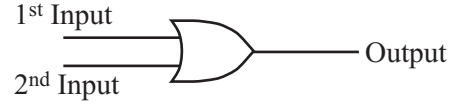
If the **4** of the circuit is increased, the capacitor will take longer to be fully energised.

QUESTION TWO

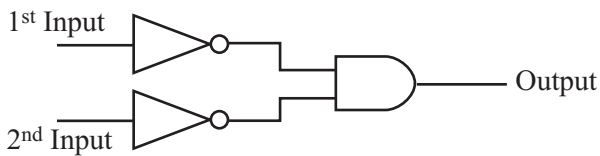
The diagrams show logic gates arranged in different ways.



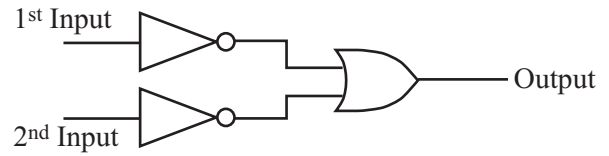
Arrangement 1



Arrangement 2



Arrangement 3



Arrangement 4

Match the truth tables **P**, **Q**, **R** and **S** with the arrangements 1–4.

Table P

1 st Input	2 nd Input	Output
0	0	1
0	1	1
1	0	1
1	1	0

Table Q

1 st Input	2 nd Input	Output
0	0	1
0	1	0
1	0	0
1	1	0

Table R

1 st Input	2 nd Input	Output
0	0	0
0	1	1
1	0	1
1	1	1

Table S

1 st Input	2 nd Input	Output
0	0	0
0	1	0
1	0	0
1	1	1

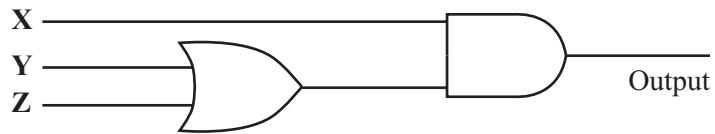
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SECTION BQuestions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

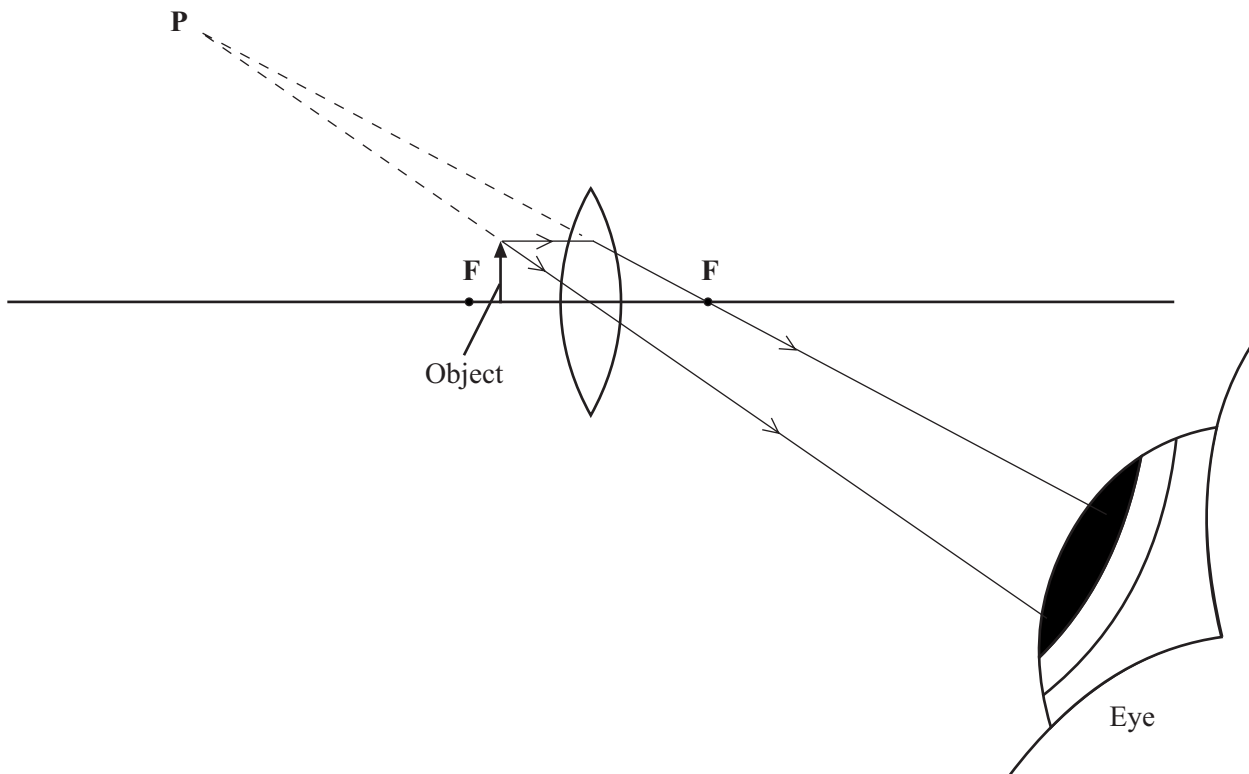
The arrangement shown uses two logic gates.

Which **two** of the rows **G**, **H**, **J**, **K** and **L** in the truth table are correct for this arrangement?

	Input X	Input Y	Input Z	Output
G	0	0	0	0
H	0	0	1	1
J	1	0	1	1
K	1	1	0	0
L	1	1	1	0

QUESTION FOUR

The diagram shows a lens being used as a magnifying glass.



Which **two** statements are correct?

rays of light are brought to a focus at the image

the image is on the same side of the lens as the object

the image is seen on a screen at point P

the image produced is a virtual image

the image produced is upside-down

Turn over ►

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

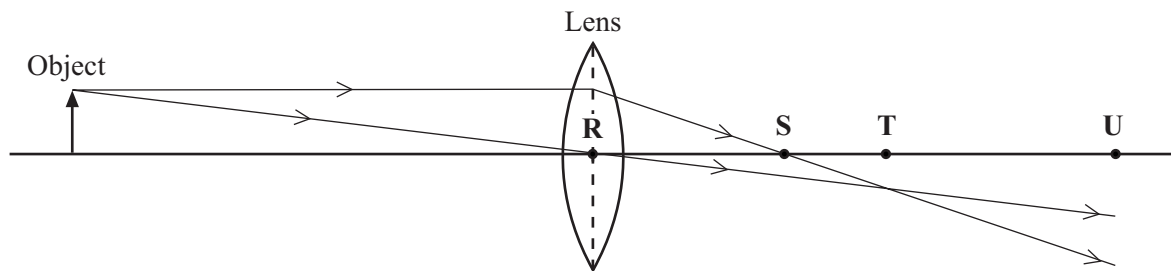
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION FIVE

The diagram shows a lens being used to produce an image of an object.

**5.1** The focus of the lens is at

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

5.2 The image is formed at

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

5.3 Compared to the object, the image is

- A** real and magnified.
- B** real and smaller.
- C** virtual and magnified.
- D** virtual and smaller.

5.4 The system shown could be used in a

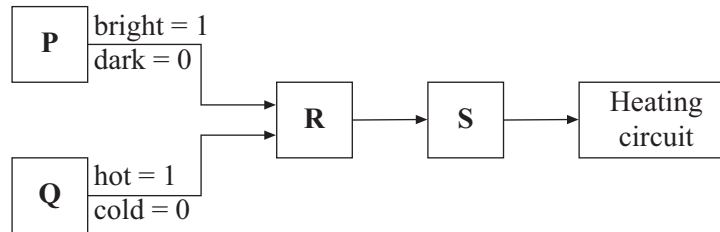
- A** camera.
- B** magnifying glass.
- C** slide projector.
- D** telescope.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SIX

A gardener wants a heating system to come on if it is both dark **and** cold in her greenhouse.



6.1 For **P** she could use

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

6.2 For **Q** she could use

- A** a heater.
- B** an OR gate.
- C** a relay.
- D** a thermistor.

6.3 For **R** she could use

- A** an AND gate.
- B** an OR gate.
- C** a relay.
- D** a thermistor.

6.4 For **S** she could use

- A** an AND gate.
- B** a NOT gate.
- C** a relay.
- D** a thermistor.

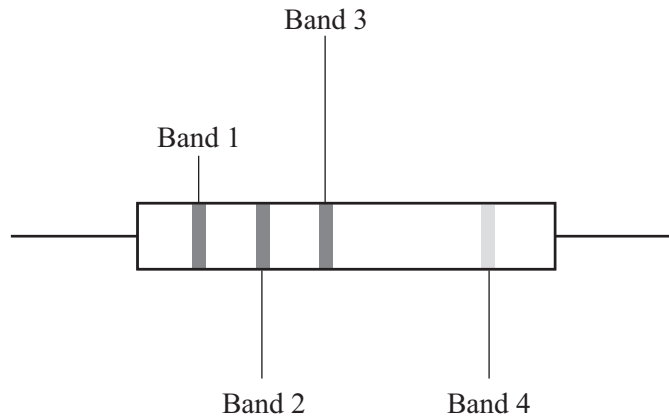
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SEVEN

The colour code for resistors is shown in the table.

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



7.1 A resistor has the following code:

Band 1	Band 2	Band 3
orange	yellow	red

What is its resistance?

- A 243 Ω
- B 342 Ω
- C 3 400 Ω
- D 24 000 Ω

7.2 What are the colour bands on a 72 Ω resistor?

	Band 1	Band 2	Band 3
A	black	red	violet
B	black	violet	red
C	violet	red	black
D	violet	red	brown

7.3 What information does Band 4 give about the resistor?

- A Accuracy of the value
- B Diameter
- C Temperature range
- D Year of production

7.4 An LDR does not have a colour code on it.

This is because

- A it has a resistance which is too high for the code.
- B it has a resistance which is too low for the code.
- C it has a varying resistance.
- D it is an input sensor.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

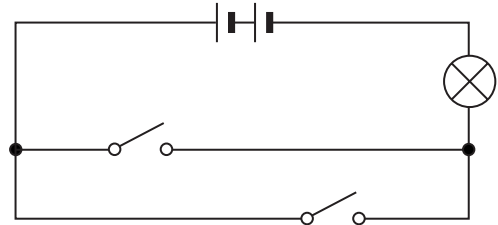
QUESTION EIGHT

In the circuits in this question, each switch represents an input.

The lamp represents the output.

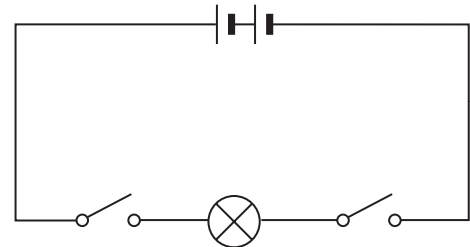
8.1 This circuit represents

- A an AND gate.
- B an OR gate.
- C an OR gate followed by a NOT gate.
- D a NOT gate.



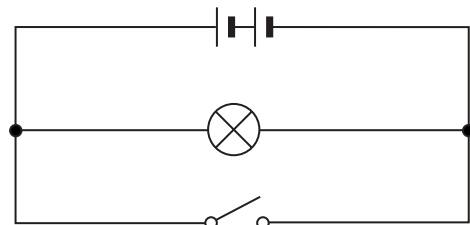
8.2 This circuit represents

- A an AND gate.
- B an OR gate.
- C an OR gate followed by a NOT gate.
- D a NOT gate.



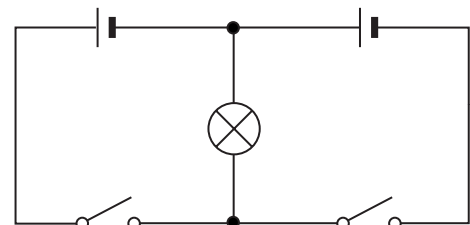
8.3 This circuit represents

- A an AND gate.
- B an OR gate.
- C an OR gate followed by a NOT gate.
- D a NOT gate.



8.4 The lamp in this circuit lights

- A only when both switches are closed.
- B only when both switches are open.
- C when either switch is closed and when both switches are closed.
- D when either switch is closed, but **not** when both switches are closed.



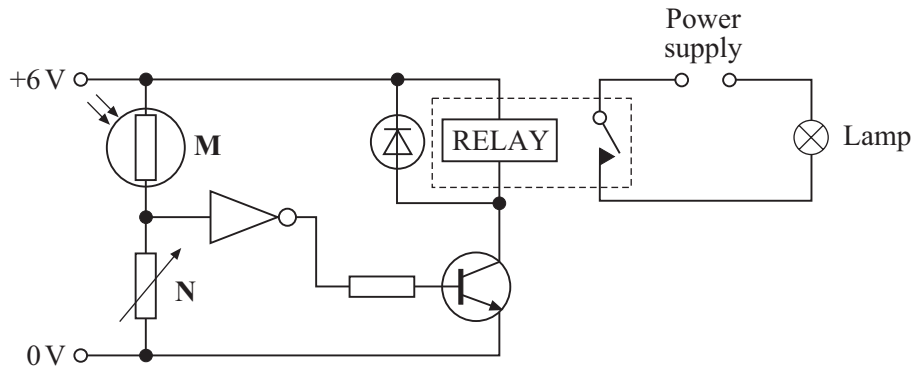
NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The circuit shown can be used as a light-dependent switch. It switches on a lamp when it is dark outside.



9.1 In this circuit, the transistor acts as

- A an amplifier.
- B an input sensor.
- C a switch.
- D protection for the diode.

9.2 As the amount of light decreases, the resistance of component **M** increases.

This means that

- A the voltage across **M** decreases, and the voltage across **N** increases.
- B the voltage across **M** increases, and the voltage across **N** decreases.
- C the voltages across **M** and **N** both decrease.
- D the voltages across **M** and **N** both increase.

9.3 The purpose of the diode is to protect

- A** the lamp when the relay is switched on.
- B** the relay when the lamp is switched on.
- C** the transistor when the relay is switched off.
- D** the transistor when the relay is switched on.

9.4 The circuit can be changed so that it gives a warning when a machine becomes too hot.

Which of the statements is correct?

- A** **M** should be an LDR, and the output device could be an LDR
- B** **M** should be an LDR, and the output device could be an LED
- C** **M** should be a thermistor, and the output device could be an LDR
- D** **M** should be a thermistor, and the output device could be an LED

TURN OVER FOR THE NEXT QUESTION

Turn over ►

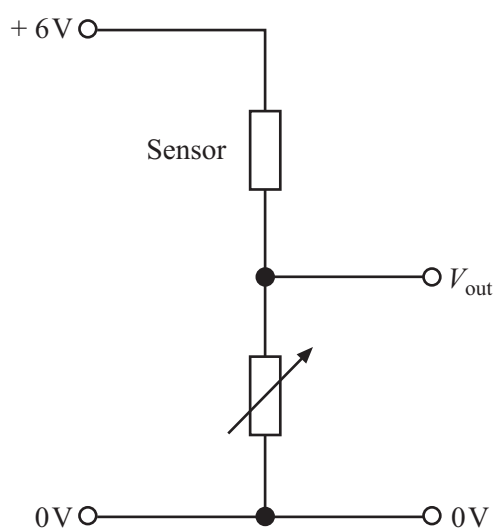
QUESTION TEN

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

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

The variable resistor in the potential divider circuit has been adjusted to a resistance of 300Ω .

The sensor resistance can change, but initially it is 900Ω .



10.1 What is the value of V_{out} ?

- A 1.5 V
- B 2.0 V
- C 4.5 V
- D 24.0 V

10.2 What is the value of the potential difference across the sensor?

- A 1.5 V
- B 3.0 V
- C 4.5 V
- D 5.5 V

10.3 The conditions affecting the sensor change and its resistance rises to $1200\ \Omega$.

What is the value of V_{out} now?

A 1.2 V

B 1.5 V

C 4.5 V

D 5.4 V

10.4 The sensor resistance stays at $1200\ \Omega$. The variable resistor is adjusted so that V_{out} is 2 V.

What is the resistance of the variable resistor now?

A $100\ \Omega$

B $400\ \Omega$

C $450\ \Omega$

D $600\ \Omega$

END OF TEST

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