

Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
June 2003



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

346023

Tuesday 24 June 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

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"/>
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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

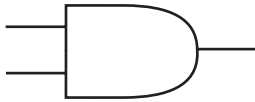
Match words from the list with each of the symbols **1–4**.

AND gate

capacitor

LED

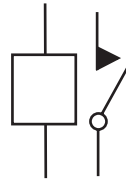
relay



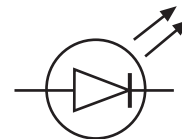
1



2



3



4

QUESTION TWO

Electronic systems contain different parts.

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

input sensors

logic gates

output devices

processors

Electronic systems have **1** which detect changes in the environment.

The action needed is decided by **2**

These can be made using **3** which control **4**

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION THREE

In electronic systems, different components have different functions.

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

capacitor

LDR

motor

thermistor

Component	Function
1	detects changes in light
2	can be used as a simple timer
3	detects changes in temperature
4	used as an output device

QUESTION FOUR

The playing surface at a stadium has a device under the ground. When the temperature falls below zero, the device is switched on. This melts any ice, and keeps the playing surface safe for the players.

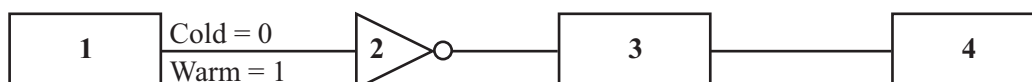
Match components in the list with the positions **1–4** in the diagram.

heater

NOT gate

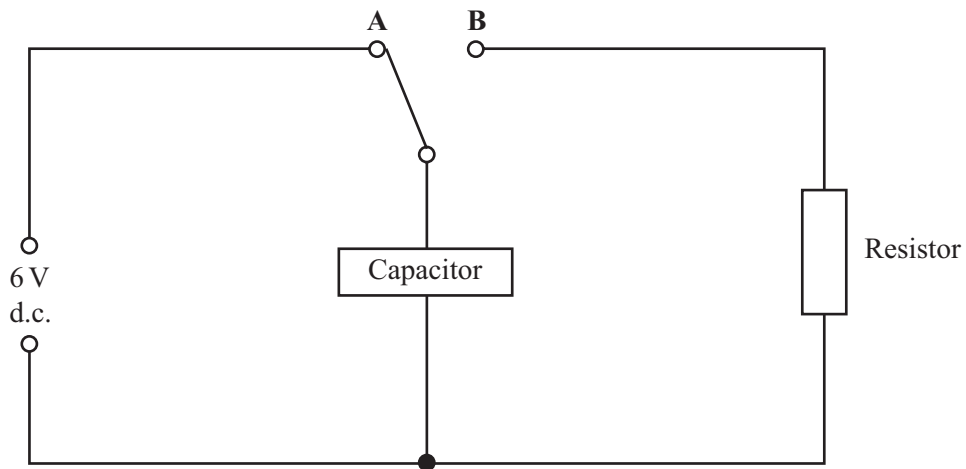
relay

temperature sensor



QUESTION FIVE

The diagram shows a circuit for charging and discharging a capacitor.



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

charge

current

resistance

voltage

When the switch is moved from position **A** to position **B**, a **1** flows through the resistor.

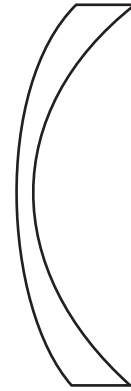
The **2** stored by the capacitor decreases, and the **3** across it also decreases.

The greater the **4**, the longer this process takes.

TURN OVER FOR THE NEXT QUESTION

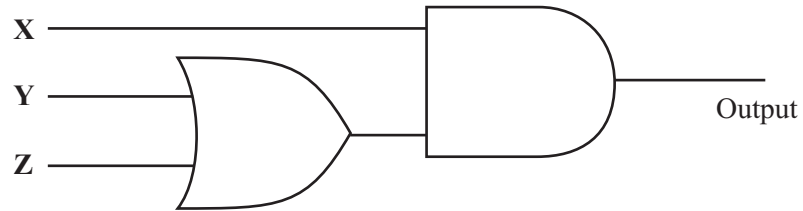
Turn over ►

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 SIXWhich **two** of the lenses shown could be used in a simple camera?**P****Q****R****S****T**

QUESTION SEVEN

The arrangement shown uses two logic gates.



Which **two** rows, **A**, **B**, **C**, **D** or **E**, in the truth table are correct for this arrangement?

	Input X	Input Y	Input Z	Output
A	0	0	0	0
B	0	0	1	1
C	1	1	0	0
D	1	0	1	1
E	1	1	1	0

TURN OVER FOR THE NEXT QUESTION

Turn over ►

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

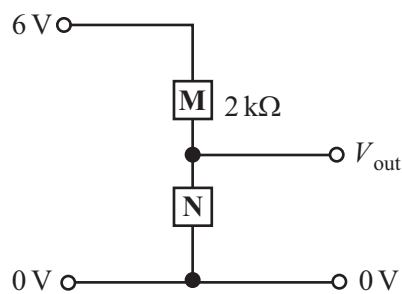
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION EIGHT

The diagram shows an arrangement used in electronic circuits.



You may find the following formula useful for some parts of this question.

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

- 8.1** The arrangement shown is called a
- A** buffer.
 - B** potential divider.
 - C** relay.
 - D** time delay switch.
- 8.2** What is the voltage across **N** when its resistance is 4 kΩ?
- A** 2 V
 - B** 3 V
 - C** 4 V
 - D** 6 V

- 8.3** What is the voltage across **M** when the resistance of **N** is 1 k Ω ?
- A** 2 V
 - B** 3 V
 - C** 4 V
 - D** 6 V
- 8.4** The arrangement can provide the correct input to an electronic circuit. To do this,
- A** **M** is a fixed resistor, and **N** is a processor.
 - B** **M** is an input device, and **N** is a variable resistor.
 - C** **M** is an output device, and **N** is a fixed resistor.
 - D** **M** is a processor, and **N** is a fixed resistor.

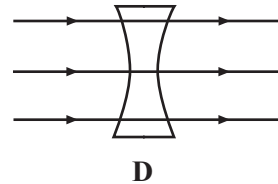
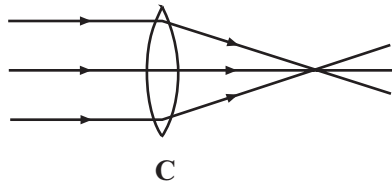
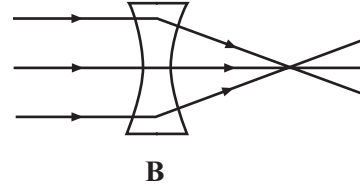
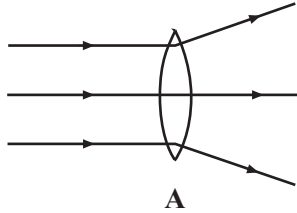
TURN OVER FOR THE NEXT QUESTION

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QUESTION NINE

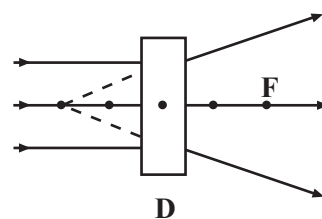
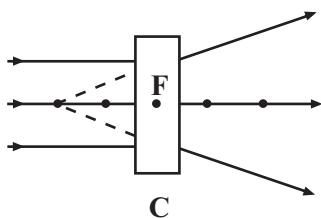
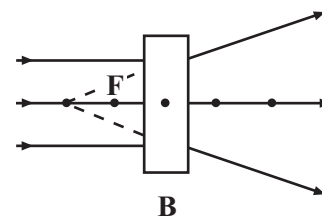
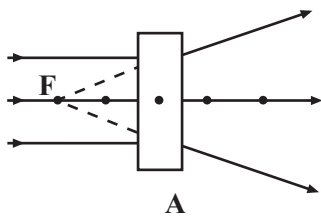
A camera uses a lens to produce an image.

9.1 Which of the diagrams correctly shows parallel rays of light passing through a lens?



9.2 A box contains a diverging lens.

Which diagram correctly shows the position of the focus (F) of the lens?



9.3 A camera produces an image on the film.

Which statement correctly describes the image?

- A** It is larger than the object, and closer to the lens
- B** It is larger than the object, and further from the lens
- C** It is smaller than the object, and closer to the lens
- D** It is smaller than the object, and further from the lens

9.4 The camera forms a real image on the film.

Which statement correctly describes a **virtual** image?

- A** Rays of light do not pass through it, and it can be formed on a screen
- B** Rays of light do not pass through it, and it cannot be formed on a screen
- C** Rays of light pass through it, and it can be formed on a screen
- D** Rays of light pass through it, and it cannot be formed on a screen

TURN OVER FOR THE NEXT QUESTION

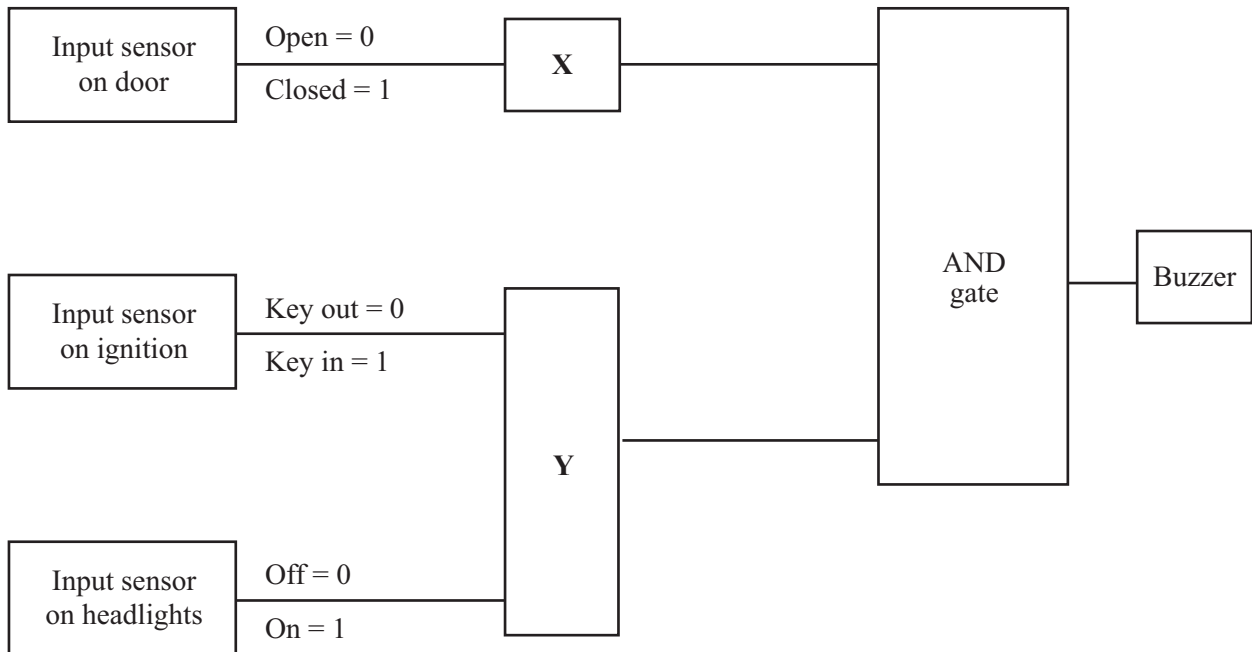
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QUESTION TEN

In some cars a buzzer sounds when the driver's door is opened.

This happens if the key is still in the ignition. It will also happen if the headlights are on.

The diagram shows the electronic system.



10.1 For **X** you could use

- A** an AND gate.
- B** an LDR.
- C** an LED.
- D** a NOT gate.

10.2 For **Y** you could use

- A** an AND gate.
- B** an LDR.
- C** an LED.
- D** an OR gate.

10.3 Which is the truth table for an AND gate?

A

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

B

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

C

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

D

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

10.4 Which row of the table is **not** correct for the whole system?

	Door sensor	Ignition sensor	Headlight sensor	Output
A	0	0	0	0
B	1	0	0	0
C	0	1	0	0
D	0	1	1	1

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**.

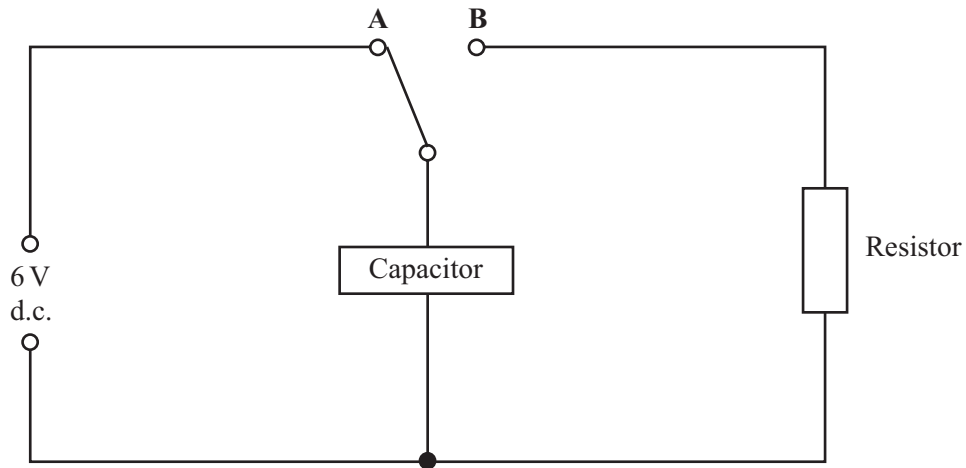
In these questions match the words in the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a circuit for charging and discharging a capacitor.



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

charge

current

resistance

voltage

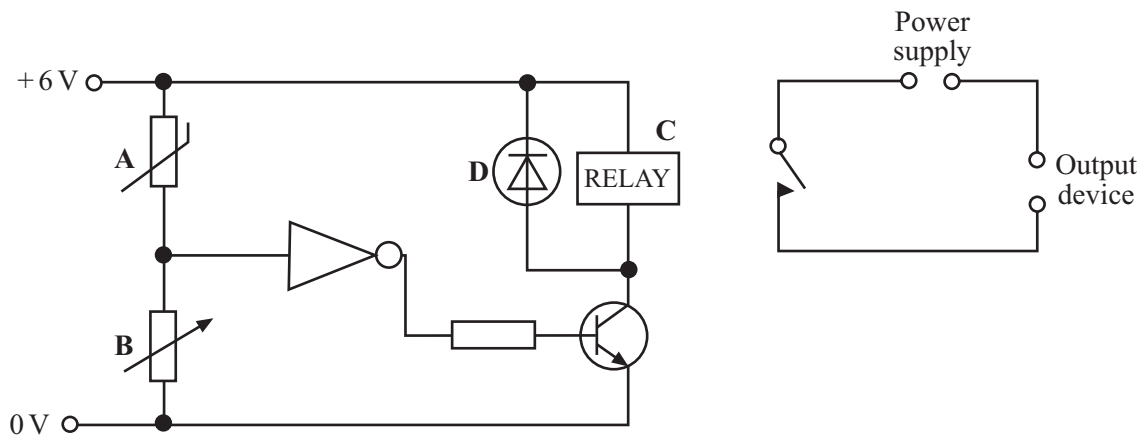
When the switch is moved from position **A** to position **B**, a **1** flows through the resistor.

The **2** stored by the capacitor decreases, and the **3** across it also decreases.

The greater the **4**, the longer this process takes.

QUESTION TWO

The circuit shown can be used as a temperature dependent switch.



Match each component, A, B, C and D, with its description 1–4.

	Description
1	acts as a switch
2	gives protection when relay is switched off
3	controls temperature at which output device switches on
4	detects changes in temperature

TURN OVER FOR THE NEXT QUESTION

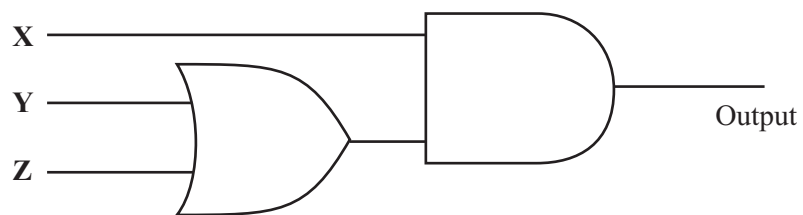
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SECTION BQuestions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

The arrangement shown uses two logic gates.

Which **two** rows, **A**, **B**, **C**, **D** or **E**, in the truth table are correct for this arrangement?

	Input X	Input Y	Input Z	Output
A	0	0	0	0
B	0	0	1	1
C	1	1	0	0
D	1	0	1	1
E	1	1	1	0

QUESTION FOUR

The use of electronic systems has advantages and disadvantages.

Which **two** statements, **P**, **Q**, **R**, **S** or **T**, describe **disadvantages** of new technology?

P	CCTV in town centres means that people lose their privacy
Q	pay-as-you-go schemes for mobile phones mean that you only pay when you use the phone
R	people feel safer on a car journey if they have a mobile phone with them
S	people worry about the health risks of having mobile phone masts near schools
T	students have access to a wealth of information on the internet

TURN OVER FOR THE NEXT QUESTION

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

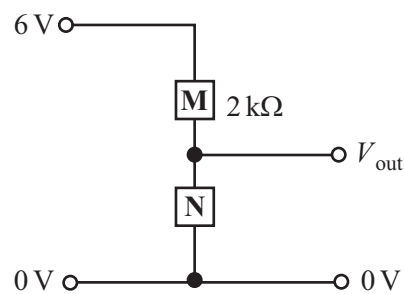
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION FIVE

The diagram shows an arrangement used in electronic circuits.



You may find the following formula useful for some parts of this question.

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

- 5.1** The arrangement shown is called a
- A** buffer.
 - B** potential divider.
 - C** relay.
 - D** time delay switch.
- 5.2** What is the voltage across **N** when its resistance is 4 kΩ?
- A** 2 V
 - B** 3 V
 - C** 4 V
 - D** 6 V

- 5.3** What is the voltage across **M** when the resistance of **N** is 1 k Ω ?
- A** 2 V
 - B** 3 V
 - C** 4 V
 - D** 6 V
- 5.4** The arrangement can provide the correct input to an electronic circuit. To do this,
- A** **M** is a fixed resistor, and **N** is a processor.
 - B** **M** is an input device, and **N** is a variable resistor.
 - C** **M** is an output device, and **N** is a fixed resistor.
 - D** **M** is a processor, and **N** is a fixed resistor.

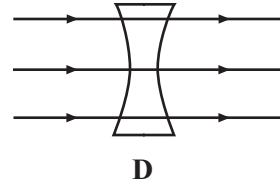
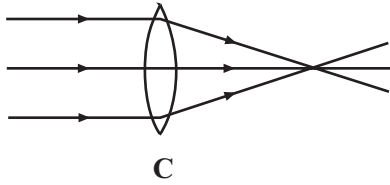
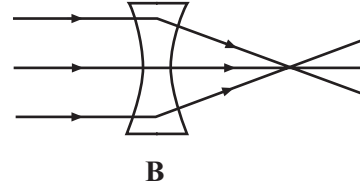
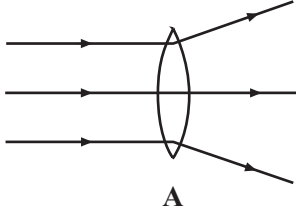
TURN OVER FOR THE NEXT QUESTION

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QUESTION SIX

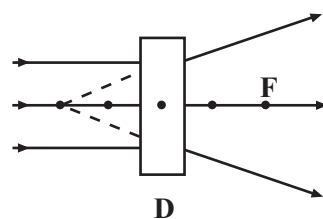
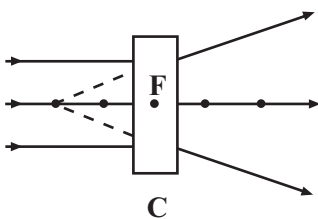
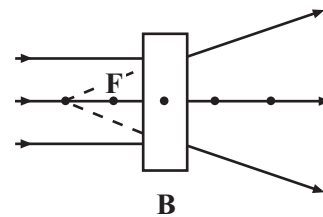
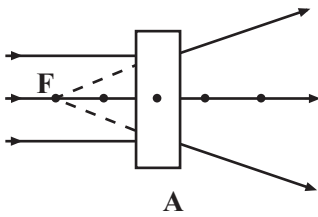
A camera uses a lens to produce an image.

6.1 Which of the diagrams correctly shows parallel rays of light passing through a lens?



6.2 A box contains a diverging lens.

Which diagram correctly shows the position of the focus (F) of the lens?



6.3 A camera produces an image on the film.

Which statement correctly describes the image?

- A** It is larger than the object, and closer to the lens
- B** It is larger than the object, and further from the lens
- C** It is smaller than the object, and closer to the lens
- D** It is smaller than the object, and further from the lens

6.4 The camera forms a real image on the film.

Which statement correctly describes a **virtual** image?

- A** Rays of light do not pass through it, and it can be formed on a screen
- B** Rays of light do not pass through it, and it cannot be formed on a screen
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- D** Rays of light pass through it, and it cannot be formed on a screen

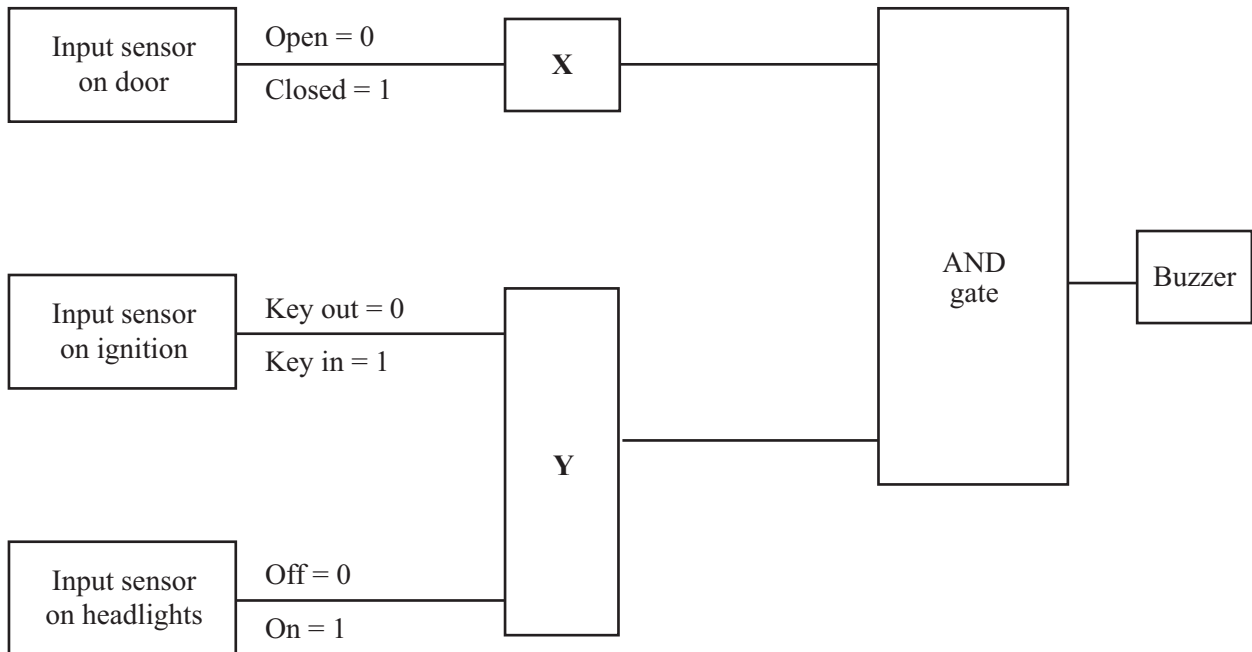
TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SEVEN

In some cars a buzzer sounds when the driver's door is opened. This happens if the key is still in the ignition. It will also happen if the headlights are on.

The diagram shows the electronic system.



7.1 For X you could use

- A an AND gate.
- B an LDR.
- C an LED.
- D a NOT gate.

7.2 For Y you could use

- A an AND gate.
- B an LDR.
- C an LED.
- D an OR gate.

7.3 Which is the truth table for an AND gate?

A

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

B

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

C

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

D

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

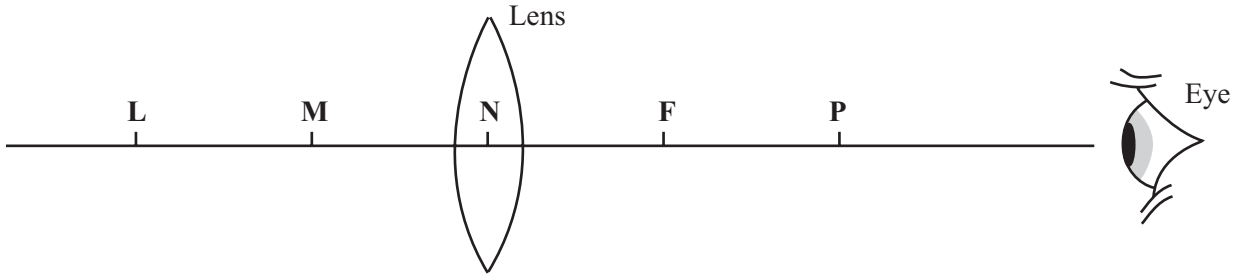
7.4 Which row of the table is **not** correct for the whole system?

	Door sensor	Ignition sensor	Headlight sensor	Output
A	0	0	0	0
B	1	0	0	0
C	0	1	0	0
D	0	1	1	1

Turn over ►

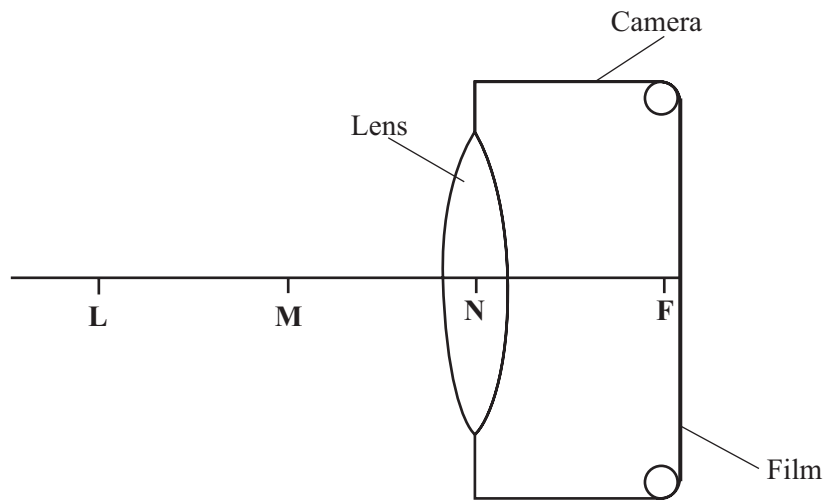
QUESTION EIGHT

The diagram shows a convex lens.
Point **F** is the principal focus of the lens.



- 8.1** When the lens is used as a magnifying glass the object must be placed
- A** at **L**.
 - B** between **L** and **M**.
 - C** at **M**.
 - D** between **M** and **N**.
- 8.2** The image formed by the magnifying glass is
- A** to the left of **M**.
 - B** between **N** and **F**.
 - C** between **F** and **P**.
 - D** to the right of **P**.
- 8.3** The image formed by the magnifying glass is
- A** upright and real.
 - B** upright and virtual.
 - C** upside down and real.
 - D** upside down and virtual.

8.4 A camera uses the same sort of lens as a magnifying glass.



In this camera the object will be

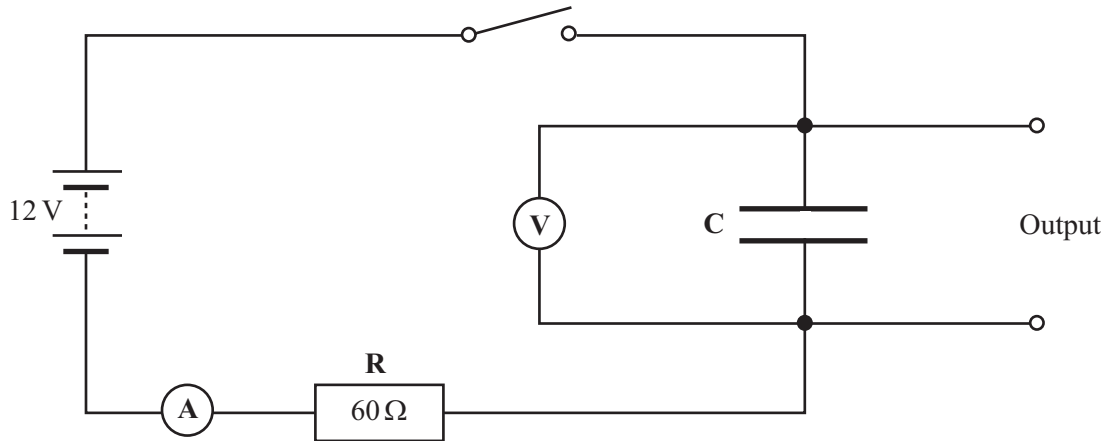
- A to the left of L.
- B at L.
- C between L and M.
- D at M.

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

The diagram shows the circuit for charging a capacitor, **C**.

The output of this circuit can be used as the input to another circuit which switches off a lamp.



9.1 This circuit can be used in

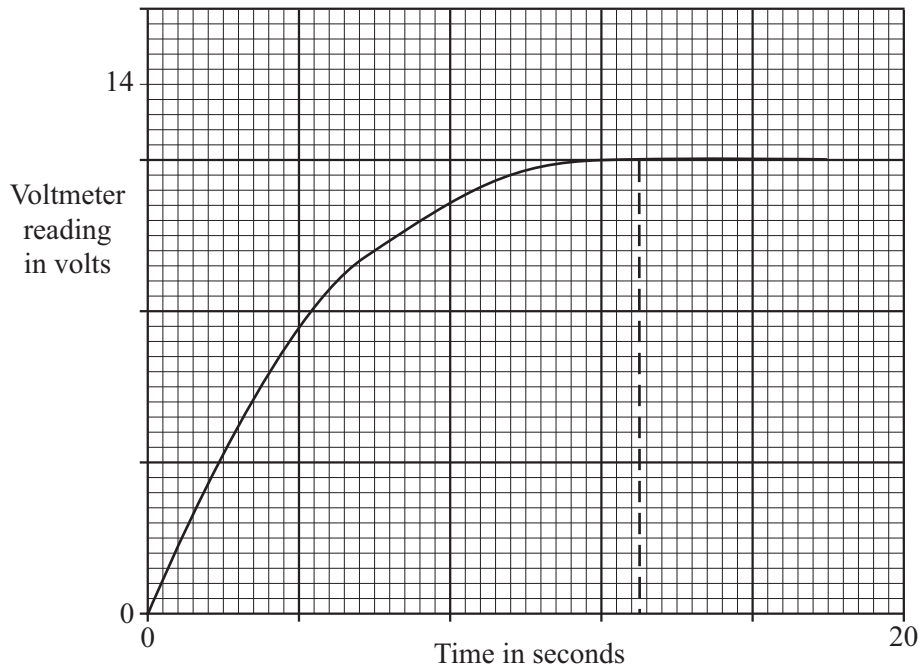
- A a light dependent switch, to switch off a lamp when it is light.
- B a pressure switch, to switch off a lamp when someone steps on a mat.
- C a temperature dependent switch, to switch a lamp off when it is hot.
- D a time delay switch, to switch off a lamp after a certain time.

9.2 The switch is closed and the readings on the meters are taken immediately.

Which of the following statements is correct?

- A Ammeter reads 0 A, voltmeter reads 0 V
- B Ammeter reads 0 A, voltmeter reads 12 V
- C Ammeter reads 0.2 A, voltmeter reads 0 V
- D Ammeter reads 5 A, voltmeter reads 0 V

9.3 The graph shows how the reading on the voltmeter changes with time after the switch is closed.



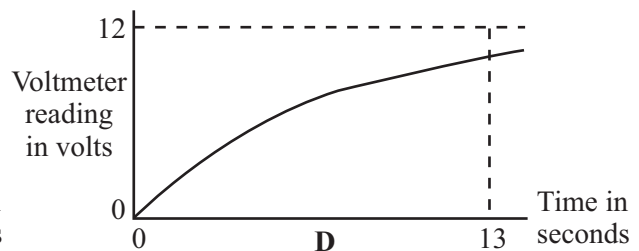
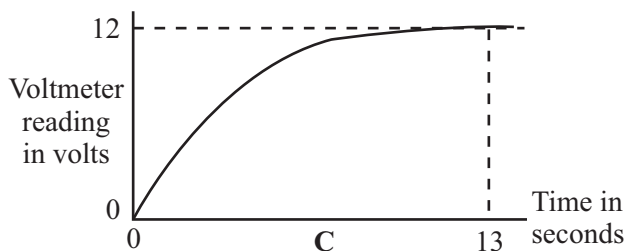
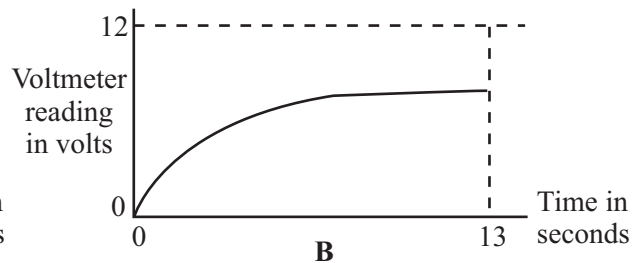
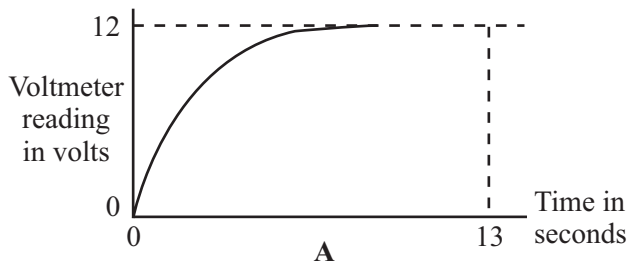
The lamp is switched off when the voltmeter reading is 6 V.

How long does it take for the voltmeter reading to reach 6 V?

- A 3.0 s
- B 8.8 s
- C 9.6 s
- D 12.0 s

9.4 The values of **C** and **R** can be changed.

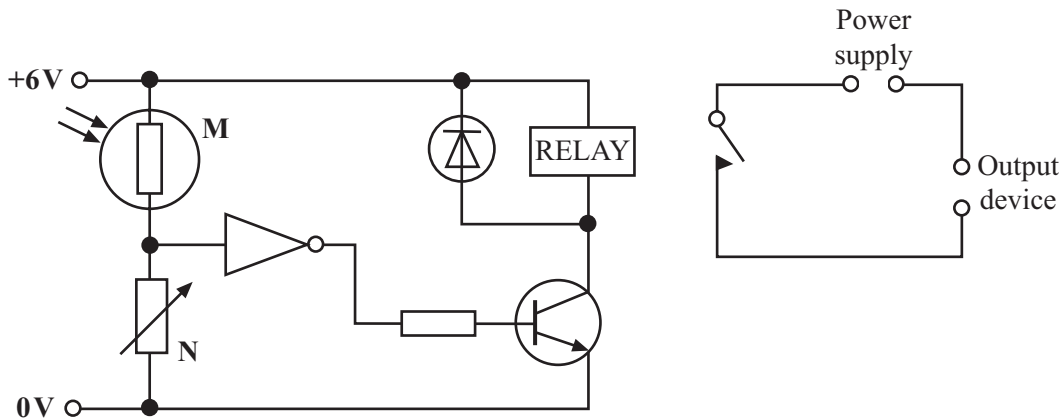
Which of the graphs shows what happens when the values of both **C** and **R** are increased?



Turn over ►

QUESTION TEN

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



10.1 In this circuit the transistor acts as

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

10.2 As the light conditions become brighter the resistance of the LDR becomes less. This means that

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

10.3 The system is not working properly. It becomes brighter, but the lamp stays on.

To correct the system you could

- A adjust the variable resistor to give it a lower resistance.
- B adjust the variable resistor to give it a higher resistance.
- C decrease the input voltage.
- D use an LDR with a higher resistance in bright conditions.

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

END OF TEST