Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
Spring 2005

ASSESSMENT and QUALIFICATIONS ALLIANCE

PHYSICS A (MODULAR) 346023
Physics in Action (Module 23)

Wednesday 2 March 2005 Morning Session

In addition to this paper you will require:
- a ball-point pen;
- an answer sheet.

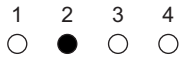
You may use a calculator.

Time allowed: 30 minutes

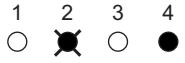
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title "Physics in Action" printed on it.
- Attempt **one Tier only**, **either** the Foundation 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

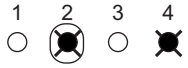
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 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 table gives the function of four different electrical components.

Match each component from the list with its function **1–4** in the table.

capacitor

lamp

LDR

thermistor

Component	Function
1	detects changes in light intensity
2	detects changes in temperature
3	gives out light
4	stores electrical charge

QUESTION TWO

The diagram shows two lenses, **X** and **Y**.

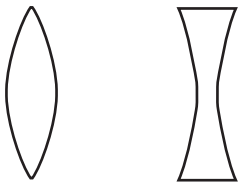
Match words from the list with the numbers **1–4** in the sentences.

converging

diverging

real

virtual



X **Y**

Lens **X** is a . . . . . **1** . . . . . lens.

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

Lens **Y** is a . . . . . **3** . . . . . lens.

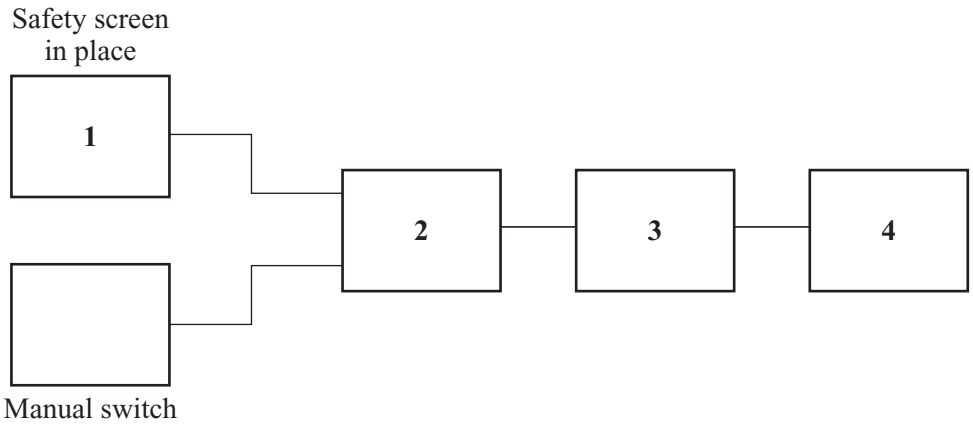
Lens **Y** cannot be used in a camera because it always forms a . . . . . **4** . . . . . image.

TURN OVER FOR THE NEXT QUESTION

QUESTION THREE

A drill in a school workshop can be used only when a safety screen is in place.

The block diagram shows the electronic control system for the drill.



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

AND gate

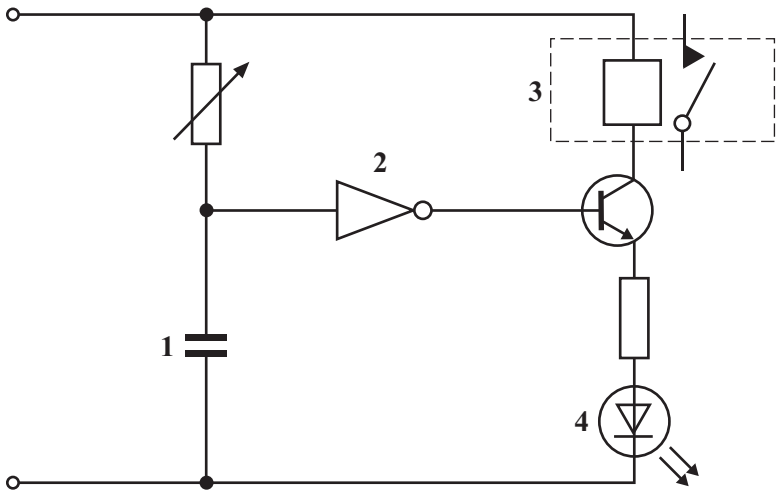
drill circuit

pressure switch

relay

QUESTION FOUR

The diagram shows part of a time delay circuit used to switch on a device.



Match components from the list with the labels **1–4** on the diagram.

capacitor

LED

NOT gate

relay

TURN OVER FOR THE NEXT QUESTION

QUESTION FIVE

Processors can be made using logic gates.

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

an AND gate

an AND gate followed by a NOT gate

a NOT gate

an OR gate

For the output of . . . . . **1** . . . . . to be on, at least one input must be off.

For the output of . . . . . **2** . . . . . to be on, both inputs must be on.

For the output of . . . . . **3** . . . . . to be on, either input may be on.

For the output of . . . . . **4** . . . . . to be on, the single input must be off.

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

This question is about capacitors.

Which **two** statements **J**, **K**, **L**, **M** and **N** are correct?

J **capacitors conduct electric current across the gap between the plates**

K **capacitors store electric current**

L **the potential difference (voltage) across a capacitor decreases when it is charging**

M **resistors in series with capacitors increase the time it takes to charge capacitors**

N **timers in electronic circuits can use capacitors**

QUESTION SEVEN

Electronic control systems use input sensors, decision-makers and output devices.

Which **two** rows **P**, **Q**, **R**, **S** and **T** in the table give the correct combination for the use stated?

	Input sensor	**Decision-maker**	**Output device**	**Use of system**
P	LDR	processor	lamp	switching on a security light at night
Q	magnetic switch	relay	LED	sounding a burglar alarm
R	pressure switch	processor	motor	opening a garage door when car is in the drive
S	thermistor	relay	heater	switching on a heating system
T	tilt switch	processor	buzzer	sounding a warning when the temperature is too high

SECTION C

Questions **EIGHT** to **TEN**.

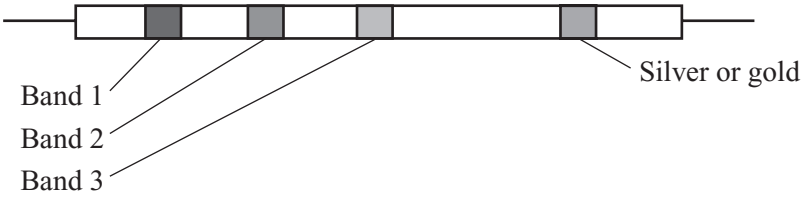
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION EIGHT

The diagram and the table show the colour code for a resistor.



Value	Colour
0	black
1	brown
2	red
3	orange
4	yellow
5	green
6	blue
7	violet
8	grey
9	white

8.1 What value of resistance is shown by the following code?

Band 1: blue Band 2: grey Band 3: red

A 68 Ω

B 6800 Ω

C 86 Ω

D 8600 Ω

8.2 All three bands are red on another resistor.

What is the resistance in kilohms?

A 0.0022

B 2.2

C 22

D 220 000

8.3 Which colour bands would be on a 47 Ω resistor?

	Band 1	**Band 2**	**Band 3**
A	yellow	violet	black
B	yellow	violet	brown
C	violet	yellow	black
D	violet	yellow	brown

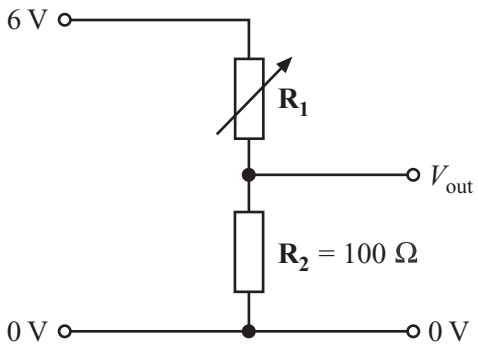
8.4 Which colour bands would be on a 7.5 MΩ (7.5 million ohm) resistor?

	Band 1	**Band 2**	**Band 3**
A	violet	brown	green
B	violet	green	black
C	violet	green	green
D	violet	green	blue

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

A potential divider is used to provide the correct input to a processor in an electronic circuit.



$\mathbf{R_1}$ is a variable resistor. Its resistance can vary between 0 and 400 Ω.

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

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

9.1 When the value of $\mathbf{R_1}$ is 0, V_{out} is . . . . .

A 0 V

B 3 V

C 6 V

D 100 V

9.2 When the value of $\mathbf{R_1}$ is 400 Ω, V_{out} is . . . . .

A 0.2 V

B 1.2 V

C 4.8 V

D 6.0 V

9.3 $\mathbf{R_2}$ is replaced by an LDR. The value of $\mathbf{R_1}$ remains at 400 Ω.

The value of V_{out} will now . . . . .

A be 0 V.

B be 6 V.

C change as the light intensity increases.

D change as the temperature increases.

9.4 $\mathbf{R_2}$ is replaced by a thermistor. The value of $\mathbf{R_1}$ remains at 400 Ω.

The value of V_{out} will now . . . . .

A be 0 V.

B be 6 V.

C change as the light intensity increases.

D change as the temperature increases.

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

Figure 1 shows an electronic system for opening a safe.

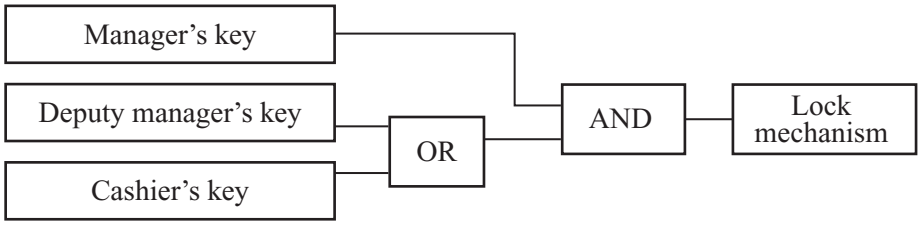


Figure 1

10.1 Which people must be present with their keys in order to open the safe?

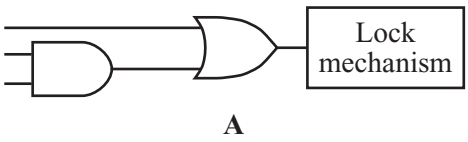
A The manager alone

B The manager with either the deputy manager or the cashier

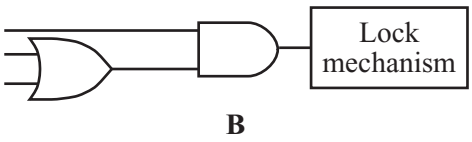
C The deputy manager and the cashier

D The manager, the deputy manager and the cashier

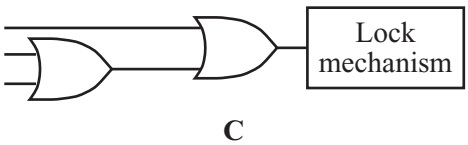
10.2 Which diagram **A**, **B**, **C** or **D** shows the same system as **Figure 1**?



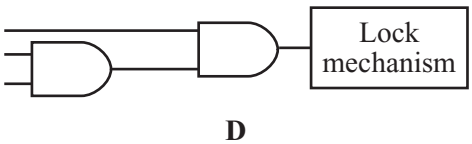
A



B



C



D

10.3 **Figure 2** shows part of the lock mechanism.

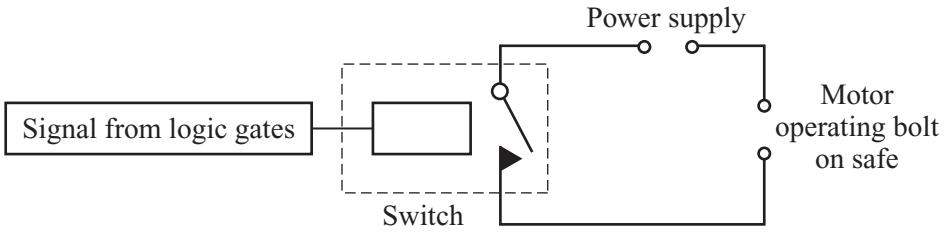


Figure 2

What is the reason for using the switch?

A It acts as a safety mechanism to prevent electric shock

B It allows the operator to put a time delay into the circuit

C It changes direct current into alternating current

D The motor needs a bigger current than that provided from the logic gates

10.4 Which of the following describes the motor?

A A processor that produces electricity

B An input device that produces movement

C An output device that produces electricity

D An output device that produces movement

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

Processors can be made using logic gates.

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

an AND gate

an AND gate followed by a NOT gate

a NOT gate

an OR gate

For the output of . . . . . **1** . . . . . to be on, at least one input must be off.

For the output of . . . . . **2** . . . . . to be on, both inputs must be on.

For the output of . . . . . **3** . . . . . to be on, either input may be on.

For the output of . . . . . **4** . . . . . to be on, the single input must be off.

QUESTION TWO

Modern electronic systems have advantages and disadvantages.

Match electronic systems from the list with the rows **1 – 4** in the table.

CCTV

e-mail

internet searching

mobile phone

	Advantage	Disadvantage
1	better security	invasion of privacy
2	increased ease of communication	possible health hazard
3	increased ease of communication	some contacts may be unsuitable
4	useful for researching topics	some material may be unsuitable

TURN OVER FOR THE NEXT QUESTION

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

Electronic control systems use input sensors, decision-makers and output devices.

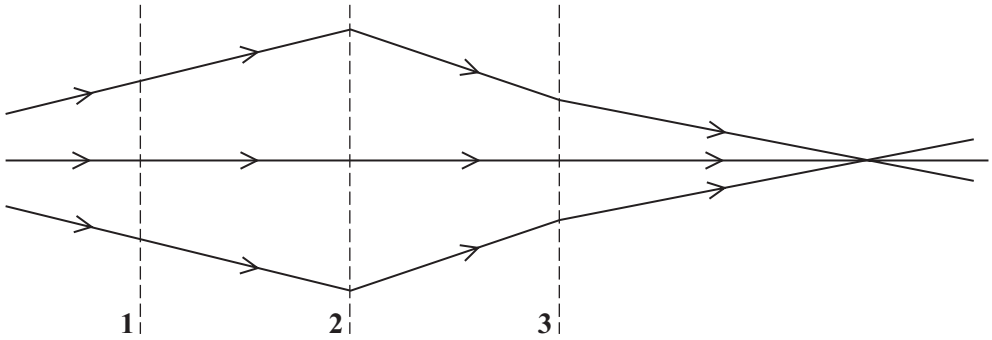
Which **two** rows **P**, **Q**, **R**, **S** and **T** in the table give the correct combination for the use stated?

	Input sensor	**Decision-maker**	**Output device**	**Use of system**
P	LDR	processor	lamp	switching on a security light at night
Q	magnetic switch	relay	LED	sounding a burglar alarm
R	pressure switch	processor	motor	opening a garage door when car is in the drive
S	thermistor	relay	heater	switching on a heating system
T	tilt switch	processor	buzzer	sounding a warning when the temperature is too high

QUESTION FOUR

A ray box produces three rays which pass through three pieces of glass at positions **1**, **2** and **3**.

The pieces of glass are a converging lens, a diverging lens and a flat sheet, but **not** necessarily in that order.



By using the paths of the rays, the order can be found.

Which **two** conclusions are correct?

1 is the flat sheet and 2 is the converging lens

1 is the flat sheet and 2 is the diverging lens

1 is the diverging lens and 3 is the converging lens

2 is the converging lens and 3 is the flat sheet

2 is the converging lens and 3 is the diverging lens

TURN OVER FOR THE NEXT QUESTION

SECTION C

Questions **FIVE** to **TEN**.

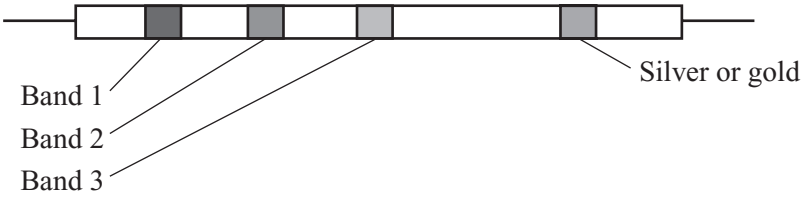
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION FIVE

The diagram and the table show the colour code for a resistor.



Value	Colour
0	black
1	brown
2	red
3	orange
4	yellow
5	green
6	blue
7	violet
8	grey
9	white

5.1 What value of resistance is shown by the following code?

Band 1: blue Band 2: grey Band 3: red

A 68 Ω

B 6800 Ω

C 86 Ω

D 8600 Ω

5.2 All three bands are red on another resistor.

What is the resistance is kilohms?

A 0.0022

B 2.2

C 22

D 220 000

5.3 Which colour bands would be on a 47 Ω resistor?

	Band 1	**Band 2**	**Band 3**
A	yellow	violet	black
B	yellow	violet	brown
C	violet	yellow	black
D	violet	yellow	brown

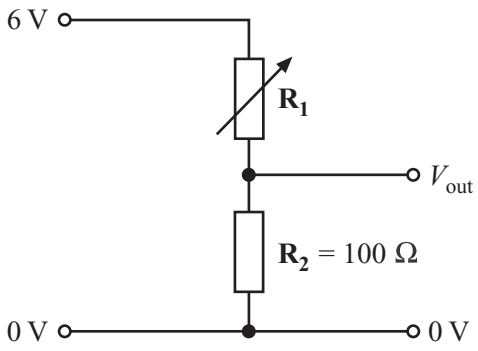
5.4 Which colour bands would be on a 7.5 MΩ (7.5 million ohm) resistor?

	Band 1	**Band 2**	**Band 3**
A	violet	brown	green
B	violet	green	black
C	violet	green	green
D	violet	green	blue

TURN OVER FOR THE NEXT QUESTION

QUESTION SIX

A potential divider is used to provide the correct input to a processor in an electronic circuit.



$\mathbf{R_1}$ is a variable resistor. Its resistance can vary between 0 and 400 Ω.

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

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

6.1 When the value of $\mathbf{R_1}$ is 0, V_{out} is . . . . .

A 0 V

B 3 V

C 6 V

D 100 V

6.2 When the value of $\mathbf{R_1}$ is 400 Ω, V_{out} is . . . . .

A 0.2 V

B 1.2 V

C 4.8 V

D 6.0 V

6.3 $\mathbf{R_2}$ is replaced by an LDR. The value of $\mathbf{R_1}$ remains at 400 Ω.

The value of V_{out} will now . . . . .

A be 0 V.

B be 6 V.

C change as the light intensity increases.

D change as the temperature increases.

6.4 $\mathbf{R_2}$ is replaced by a thermistor. The value of $\mathbf{R_1}$ remains at 400 Ω.

The value of V_{out} will now . . . . .

A be 0 V.

B be 6 V.

C change as the light intensity increases.

D change as the temperature increases.

TURN OVER FOR THE NEXT QUESTION

QUESTION SEVEN

Figure 1 shows an electronic system for opening a safe.

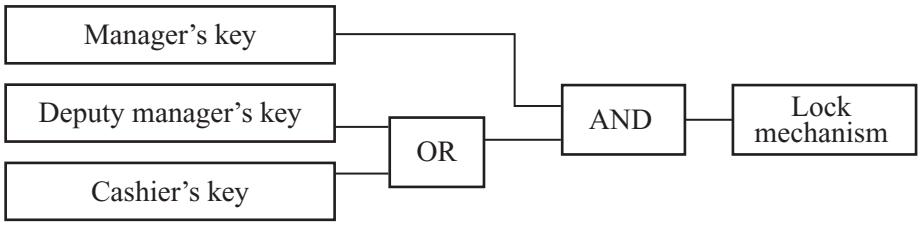


Figure 1

7.1 Which people must be present with their keys in order to open the safe?

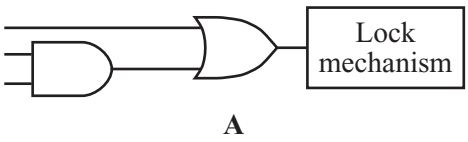
A The manager alone

B The manager with either the deputy manager or the cashier

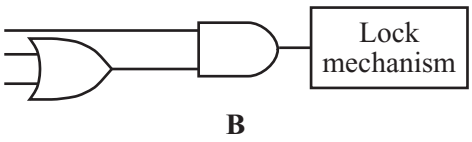
C The deputy manager and the cashier

D The manager, the deputy manager and the cashier

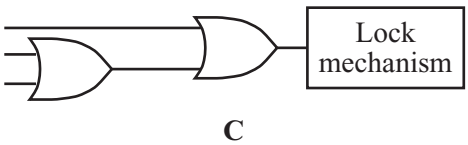
7.2 Which diagram **A**, **B**, **C** or **D** shows the same system as **Figure 1**?



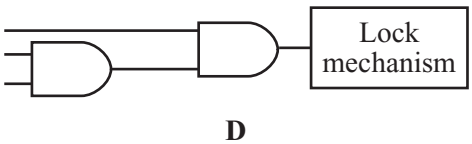
A



B



C



D

7.3 **Figure 2** shows part of the lock mechanism.

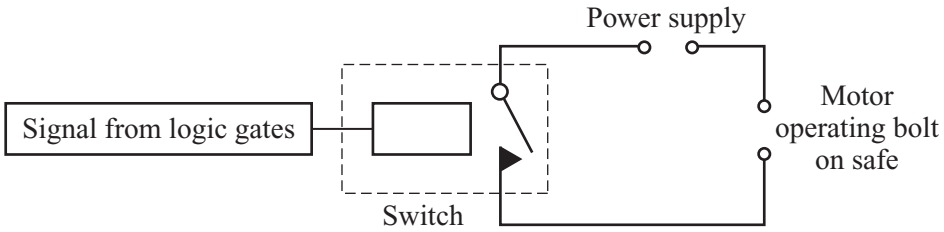


Figure 2

What is the reason for using the switch?

A It acts as a safety mechanism to prevent electric shock

B It allows the operator to put a time delay into the circuit

C It changes direct current into alternating current

D The motor needs a bigger current than that provided from the logic gates

7.4 Which of the following describes the motor?

A A processor that produces electricity

B An input device that produces movement

C An output device that produces electricity

D An output device that produces movement

TURN OVER FOR THE NEXT QUESTION

QUESTION EIGHT

Figure 1 shows a circuit suitable for charging and discharging a capacitor.

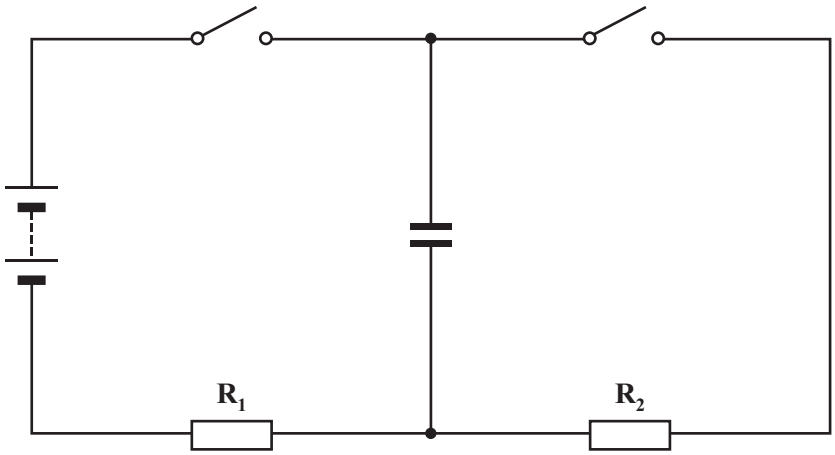


Figure 1

8.1 Which statement about the charging and discharging of the capacitor is correct?

A To charge or discharge the capacitor, both switches must be closed

B The time taken to charge the capacitor depends on the value of the resistor $\mathbf{R_2}$

C The time taken to charge and discharge the capacitor depends on the value of the capacitor

D The time taken to charge and discharge the capacitor depends on the value of the resistor $\mathbf{R_1}$

Figure 2 shows a timer circuit.
The contacts of the relay are normally open.

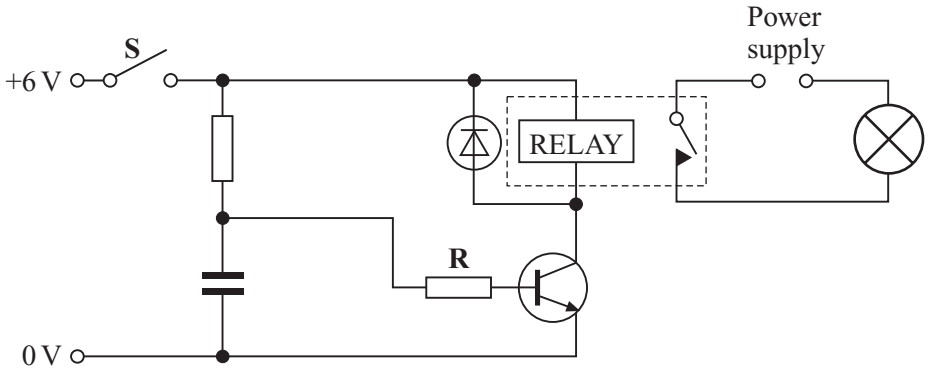


Figure 2

8.2 Switch **S** is closed.

What will happen now?

A The lamp will come on instantly and stay on

B The lamp will come on and then go off after a short time

C The lamp will come on after a short time

D The lamp will never come on

8.3 There needs to be another switch in the circuit so that it can be re-set after use.

Where should this switch be placed?

A In parallel with the battery

B In parallel with the capacitor

C In parallel with the diode

D In parallel with the lamp

8.4 What is the purpose of the diode?

A To protect the lamp from damage

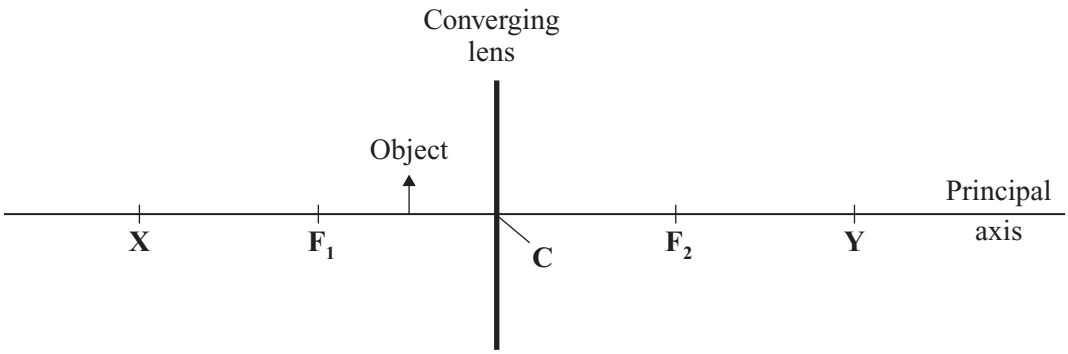
B To protect the transistor from damage

C To remove charge from the capacitor

D To reverse the current through the transistor

QUESTION NINE

The diagram shows a converging lens, the foci of the lens ($\mathbf{F_1}$ and $\mathbf{F_2}$) and the position of the object.



9.1 A ray is drawn from the top of the object to point **C**.

After it has reached **C**, the ray will . . . . .

A be reflected back through the top of the object.

B be refracted through $\mathbf{F_1}$.

C be refracted through $\mathbf{F_2}$.

D continue straight on without changing direction.

9.2 A ray is drawn from $\mathbf{F_1}$ through the top of the object.

After this ray reaches the lens, it will . . . . .

A be reflected back parallel to the principal axis.

B be reflected back through $\mathbf{F_1}$.

C emerge from the right of the lens parallel to the principal axis.

D pass through $\mathbf{F_2}$.

9.3 The image formed by the lens will be . . . . .

A real, diminished and between $\mathbf{F_2}$ and **Y**.

B virtual, magnified and between $\mathbf{F_2}$ and **Y**.

C real, magnified and to the left of the object.

D virtual, magnified and to the left of the object.

9.4 Where would it be best to place the eye in order to see the image produced by the lens?

A To the left of the lens looking left

B To the left of the lens looking right

C To the right of the lens looking left

D To the right of the lens looking right

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

All electrical appliances must be set to the correct potential difference (voltage).

10.1 This may be done by changing the setting of a . . . . .

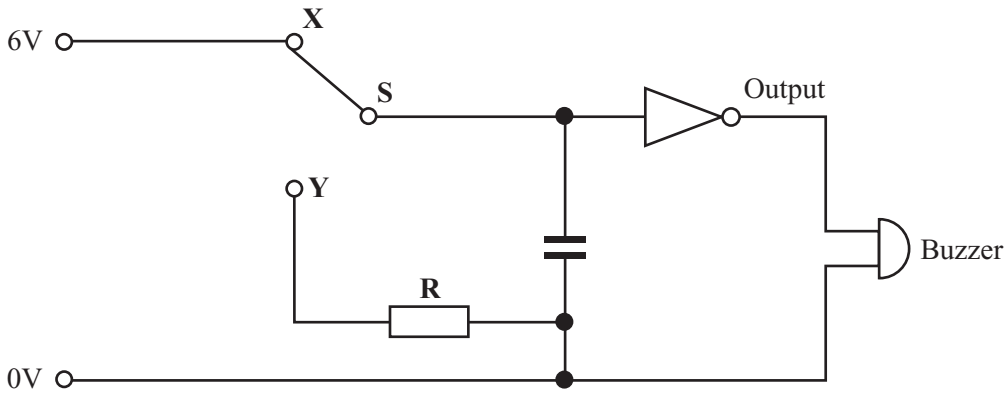
A potential divider.

B processor.

C relay.

D thermistor.

The diagram shows part of the timer switch circuit in a microwave oven.



10.2 The switch **S** can be in position **X** or in position **Y**.

When will the buzzer sound?

A Immediately, when the switch is moved from position **X** to position **Y**

B Immediately, when the switch is moved from position **Y** to position **X**

C Shortly after the switch is moved from position **X** to position **Y**

D Shortly after the switch is moved from position **Y** to position **X**

10.3 The switch is moved from position **X** to position **Y**.

Which would give the greatest increase in the time taken for the output to change?

A Doubling the resistance of **R** and doubling the value of the capacitor

B Doubling the resistance of **R** and halving the value of the capacitor

C Halving the resistance of **R** and doubling the value of the capacitor

D Halving the resistance of **R** and halving the value of the capacitor

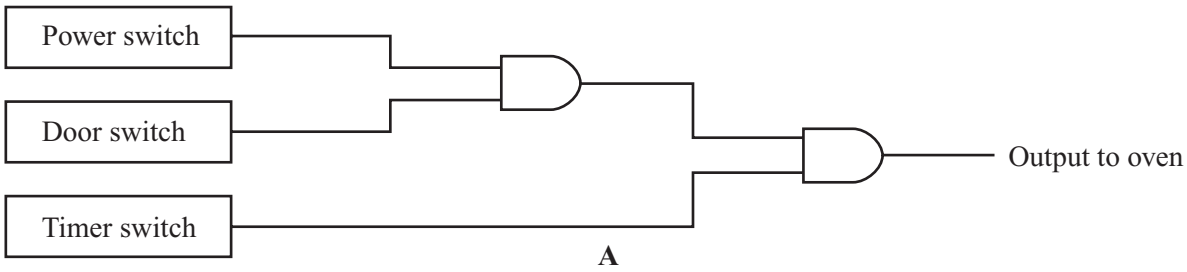
10.4 For the oven to work:

the power switch must be turned to choose a power setting
(zero setting = 0; power set = 1)

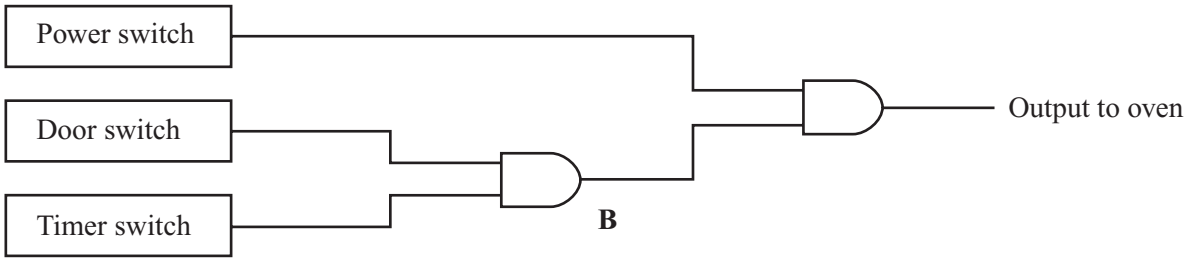
the door must be closed
(open = 0; closed = 1)

the timer switch must be turned to choose a cooking time
(zero setting = 1; cooking time set = 0)

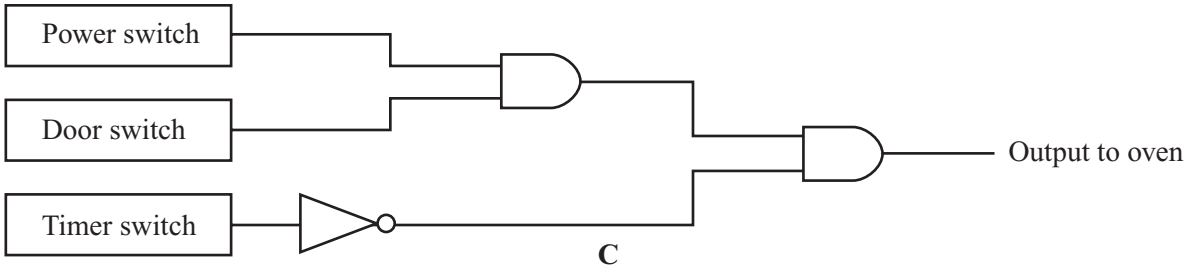
Which of the control systems **A**, **B**, **C** or **D** is needed?



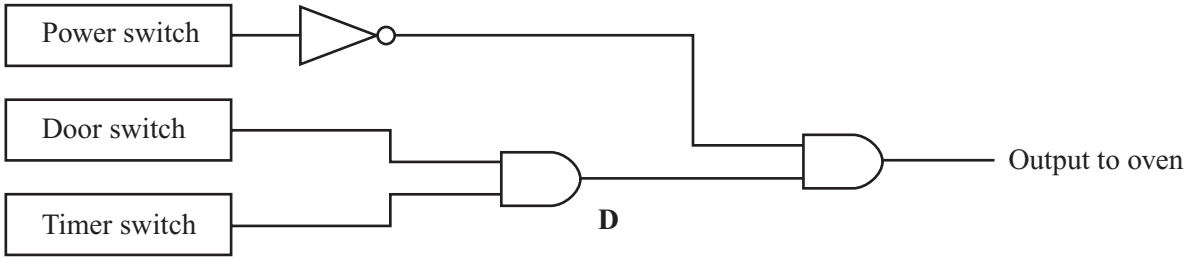
A



B



C



D

END OF TEST

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