| Surname | | Other Names | |
|---|---|---|---|
| Centre Number | | | Candidate Number | | | | |
| Candidate Signature | | | | | | | | | |

General Certificate of Secondary Education
June 2005

# SCIENCE: DOUBLE AWARD A (MODULAR) 346010
# PHYSICS A (MODULAR)
# Electricity (Module 10)

Tuesday 28 June 2005 Morning Session

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

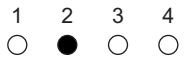
You may use a calculator.

Time allowed: 30 minutes

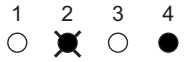
**Instructions**
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title "Electricity" printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier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

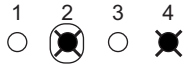
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:




- 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 16 of this booklet.

**FOUNDATION TIER**

**SECTION A**

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

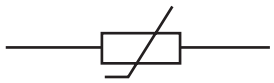
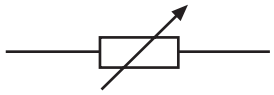
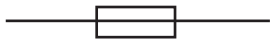
In these questions match the words in the list with the numbers.

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

Mark your choices on the answer sheet.

**QUESTION ONE**

The table shows some electrical symbols.

| Device | Symbol |
|---|---|
| **1** |  |
| **2** |  |
| **3** |  |
| **4** |  |

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

**fuse**

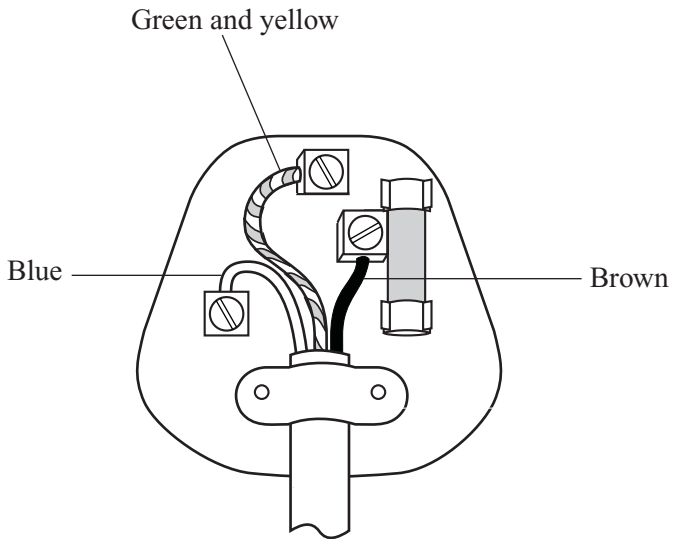
**resistor**

**thermistor**

**variable resistor**

**QUESTION TWO**

The diagram shows the inside of a three-pin plug.




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

**earth terminal**

**fuse**

**live terminal**

**neutral terminal**

The brown wire connects the appliance to the . . . . . **1** . . . . . of the mains supply.

A . . . . . **2** . . . . . is fitted inside the plug between the brown wire and the mains supply.

The blue wire connects the appliance to the . . . . . **3** . . . . . .

The green and yellow wire connects the appliance to the . . . . . **4** . . . . . .

**QUESTION THREE**

The diagram shows some information about an electric kettle.

| | |
|---|---|
| **Mains supply:** | 50 . . . . . **1** . . . . . 230 . . . . . **2** . . . . . |
| **Power:** | 2500 . . . . . **3** . . . . . |
| **Fuse:** | 13 . . . . . **4** . . . . . |

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

**amperes**

**hertz**

**volts**

**watts**

**QUESTION FOUR**

The resistance of most electrical devices can change.

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

**a diode**

**a filament lamp**

**an LDR**

**a thermistor**

The resistance of . . . . . **1** . . . . . decreases as it gets hot.

The resistance of . . . . . **2** . . . . . increases as it gets hot.

Current flows through . . . . . **3** . . . . . in one direction only. Its resistance is very high in the reverse direction.

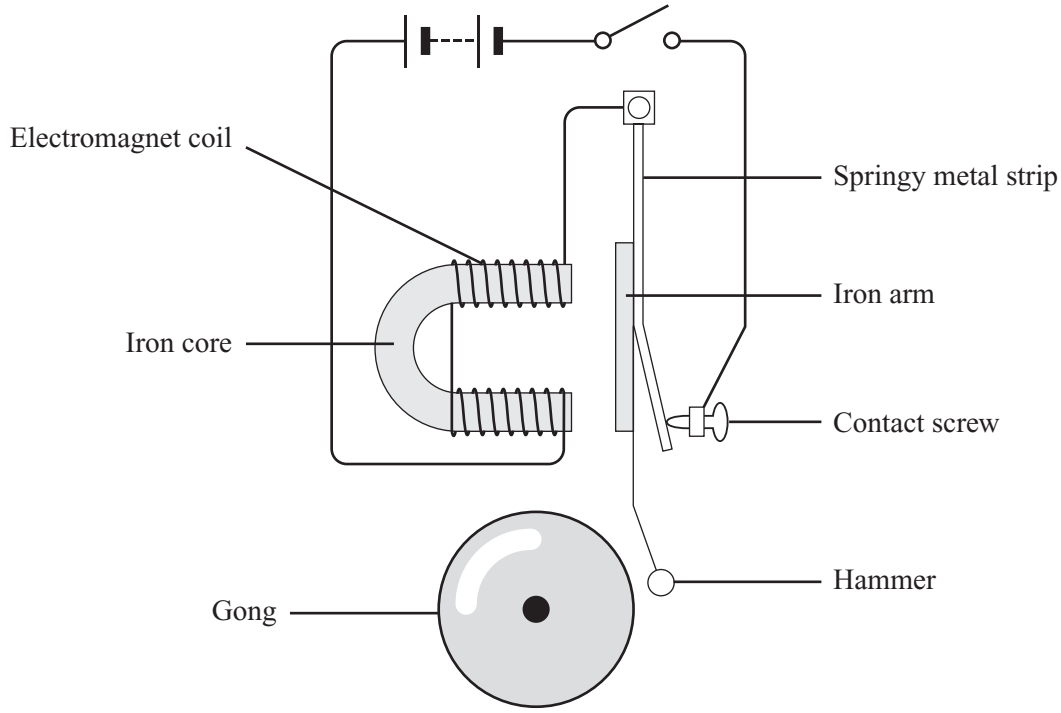
The resistance of . . . . . **4** . . . . . decreases as the surroundings become brighter.

**NO QUESTIONS APPEAR ON THIS PAGE**

**TURN OVER FOR THE NEXT QUESTION**

**QUESTION FIVE**

The diagram shows an electric bell.




The flow chart on page 7 explains how the bell works.

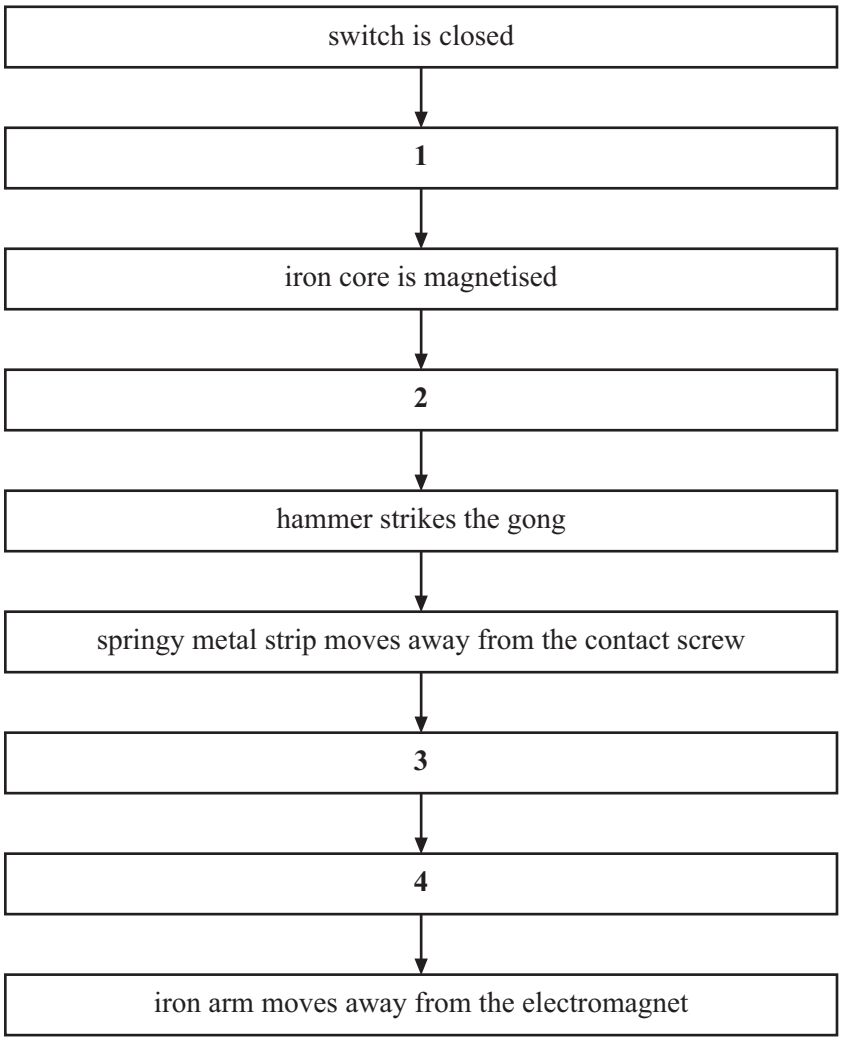
Match statements from the list with the boxes **1–4** on the flow chart.

**circuit is broken**

**current flows through the electromagnet coil**

**electromagnet is no longer magnetised**

**iron arm is attracted to the electromagnet**




**TURN OVER FOR THE NEXT QUESTION**

**SECTION B**

Questions **SIX** and **SEVEN**.

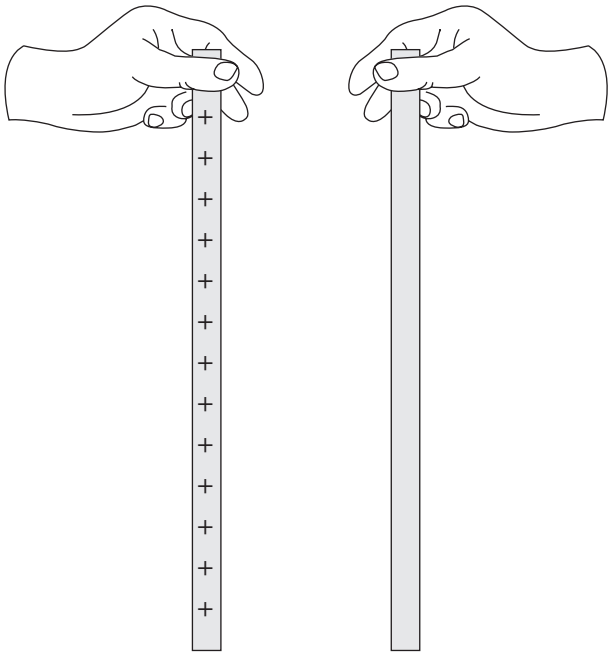
In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

**QUESTION SIX**

The diagram shows two thin strips of plastic.
One strip of plastic is electrically charged.
The other strip is uncharged.



The thin strips of plastic are now moved close to each other.

Which **two** of the following statements are true?

**the strips will attract each other**

**the strips will repel each other**

**the strips will have no effect on each other**

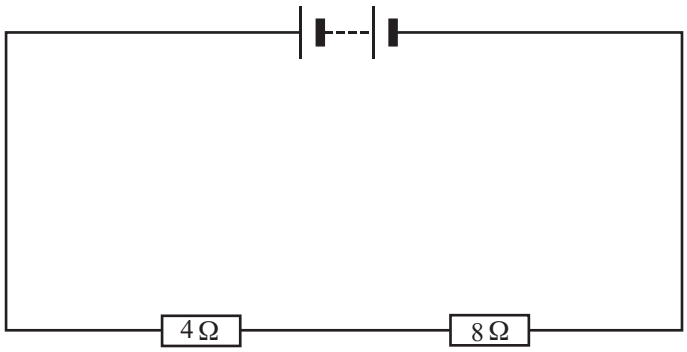
**if the uncharged strip is given a positive charge, the strips will attract each other**

**if the uncharged strip is given a positive charge, the strips will repel each other**

**QUESTION SEVEN**

A 4 Ω resistor is connected in series with an 8 Ω resistor.

The circuit is shown below.




Which **two** of the statements **P**, **Q**, **R**, **S** and **T** are correct?

**P** **the current through each resistor is the same**

**Q** **the current through the 4 Ω resistor is twice as big as the current through the 8 Ω resistor**

**R** **the potential difference (voltage) across the 4 Ω resistor is twice as big as that across the 8 Ω resistor**

**S** **the potential difference across each resistor is the same**

**T** **the total resistance is 12 Ω**

**TURN OVER FOR THE NEXT QUESTION**

**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

When insulating materials are rubbed against each other, they may become electrically charged.

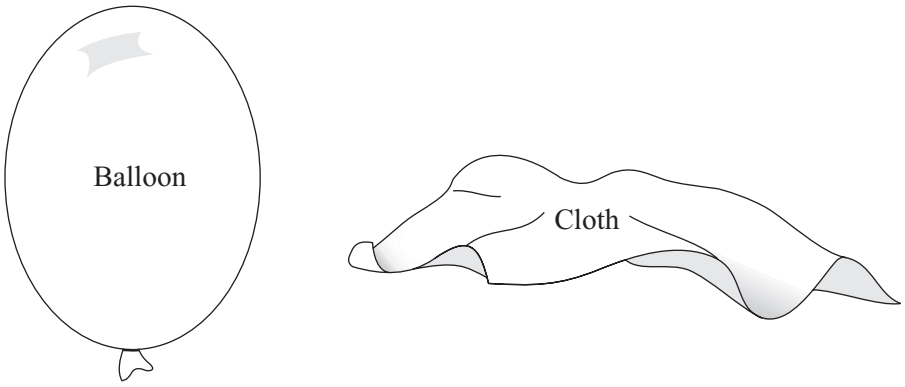



**Figure 1**

**8.1** The balloon rubbed on the cloth has become negatively charged because the balloon . . . . .

**A** attracts electrons from the air which stick to it.

**B** attracts protons from the cloth which stick to it.

**C** gains electrons transferred from the cloth by friction.

**D** repels electrons from its surface.

Electrostatic charges can be useful in everyday life.

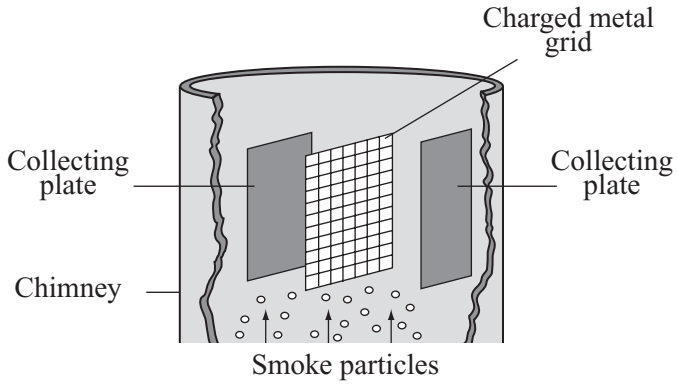



**Figure 2**

**8.2** **Figure 2** shows a . . . . .

**A** smoke detector.

**B** smoke electrode.

**C** smoke precipitator.

**D** smoke screen.

**8.3** As they travel upwards, smoke particles . . . . .

**A** are repelled downwards by the grid.

**B** become trapped in the grid.

**C** gain charge from the grid and are attracted to the plates.

**D** remain neutral and are attracted to the plates.

**8.4** The smoke particles are cleaned out of the equipment by . . . . .

**A** knocking the grid.

**B** knocking the plates.

**C** putting a charge on the chimney.

**D** reversing the charge on the grid.

**QUESTION NINE**

**Figure 1** shows a conductor **X Y**, in a magnetic field.
When the switch is closed, there is a force on the conductor **X Y**.

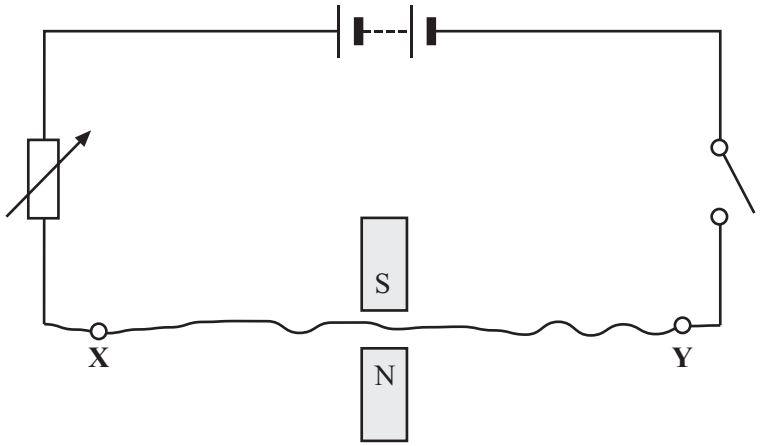



**Figure 1**

**9.1** Which line in the table gives changes which are **certain** to increase the **size** of the force?

| | **Current** | **Strength of magnetic field** |
|---|---|---|
| **A** | decreased | decreased |
| **B** | decreased | increased |
| **C** | increased | decreased |
| **D** | increased | increased |

**9.2** Which line in the table gives changes which will **not** change the **direction** of the force?

| | **Current** | **Magnetic field** |
|---|---|---|
| **A** | decreased | reversed |
| **B** | increased | reversed |
| **C** | reversed | decreased |
| **D** | reversed | reversed |

**9.3** Which of the following is based on a force acting on a conductor in a magnetic field?

**A** A battery

**B** A motor

**C** A thermistor

**D** A transformer

**9.4** The circuit breaker in **Figure 2** contains an electromagnet.

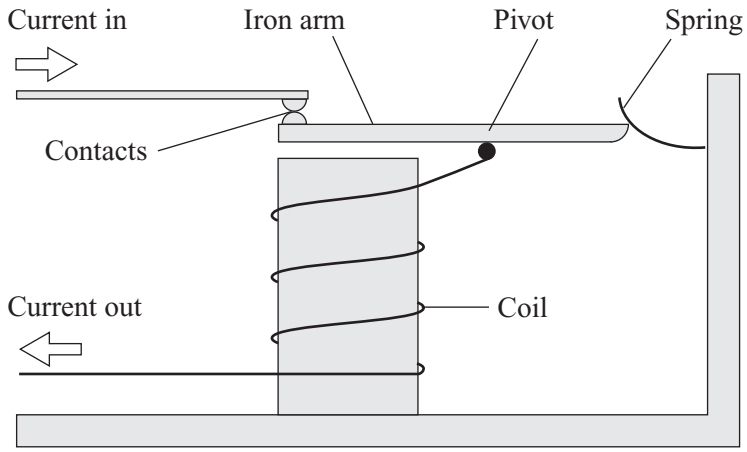



**Figure 2**

When a normal current flows, the contacts touch each other because . . . . .

**A** the contacts have become charged and attract each other.

**B** the electromagnet has attracted them.

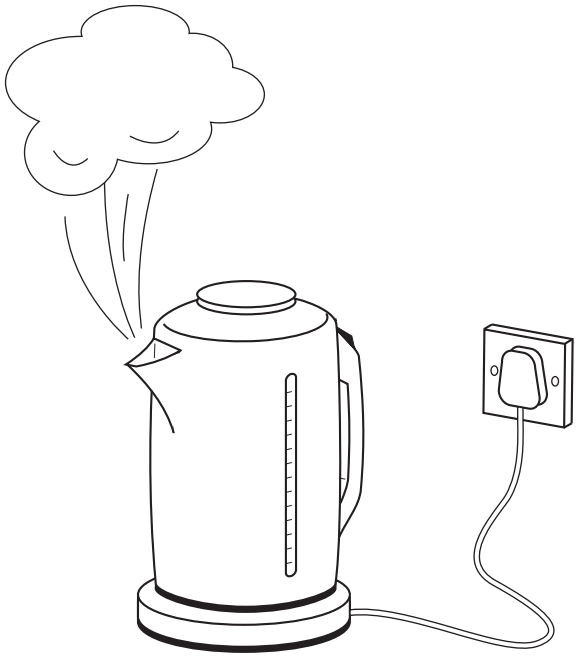
**C** the electromagnet has repelled them.

**D** the electromagnet is too weak to move the iron arm.

**TURN OVER FOR THE NEXT QUESTION**

**QUESTION TEN**

The diagram shows an electric kettle connected to the 230 V mains supply.
When the kettle is working normally, the current flowing through it is 10 A.



**10.1** Which formula can be used to calculate the power of the kettle?

**A** $\text{power} = \dfrac{\text{potential difference (voltage)}}{\text{current}}$

**B** $\text{power} = \dfrac{\text{current}}{\text{potential difference}}$

**C** power = potential difference + current

**D** power = potential difference × current

**10.2** The power of the kettle is . . . . .

**A** $\frac{1}{23}$ watt.

**B** 23 watts.

**C** 240 watts.

**D** 2300 watts.

**10.3** Some kettles have an earth lead because . . . . .

**A** the handle is made of an insulator and can become charged.

**B** the kettle is made of metal and can become charged.

**C** the kettle is made of metal and can become live.

**D** the lead to the socket is too short.

**10.4** The element of the kettle is a resistor.

Which statement best describes how the kettle works?

**A** When electric charge flows through the element, electrical energy is transferred as heat

**B** When electric charge flows through the element, heat is transferred as electrical energy

**C** When potential difference (voltage) flows through the element, electrical energy is transferred as heat

**D** When potential difference flows through the element, heat is transferred as electrical energy

**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**.

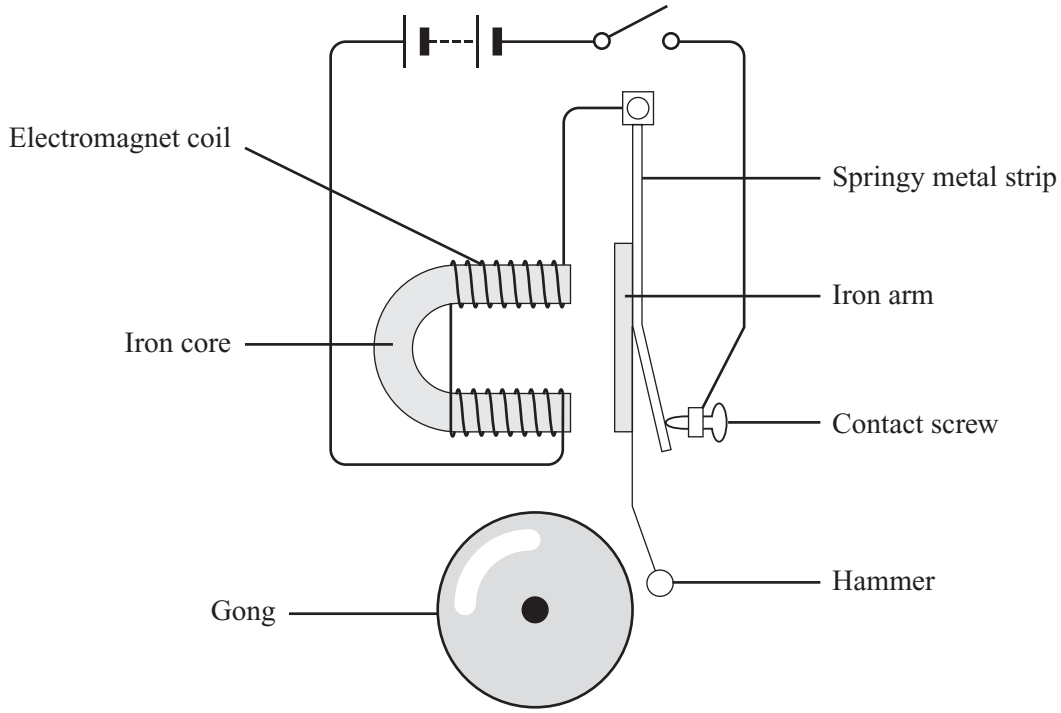
In these questions match the words in the list with the numbers.

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

Mark your choices on the answer sheet.

**QUESTION ONE**

The diagram shows an electric bell.




The flow chart on page 17 explains how the bell works.

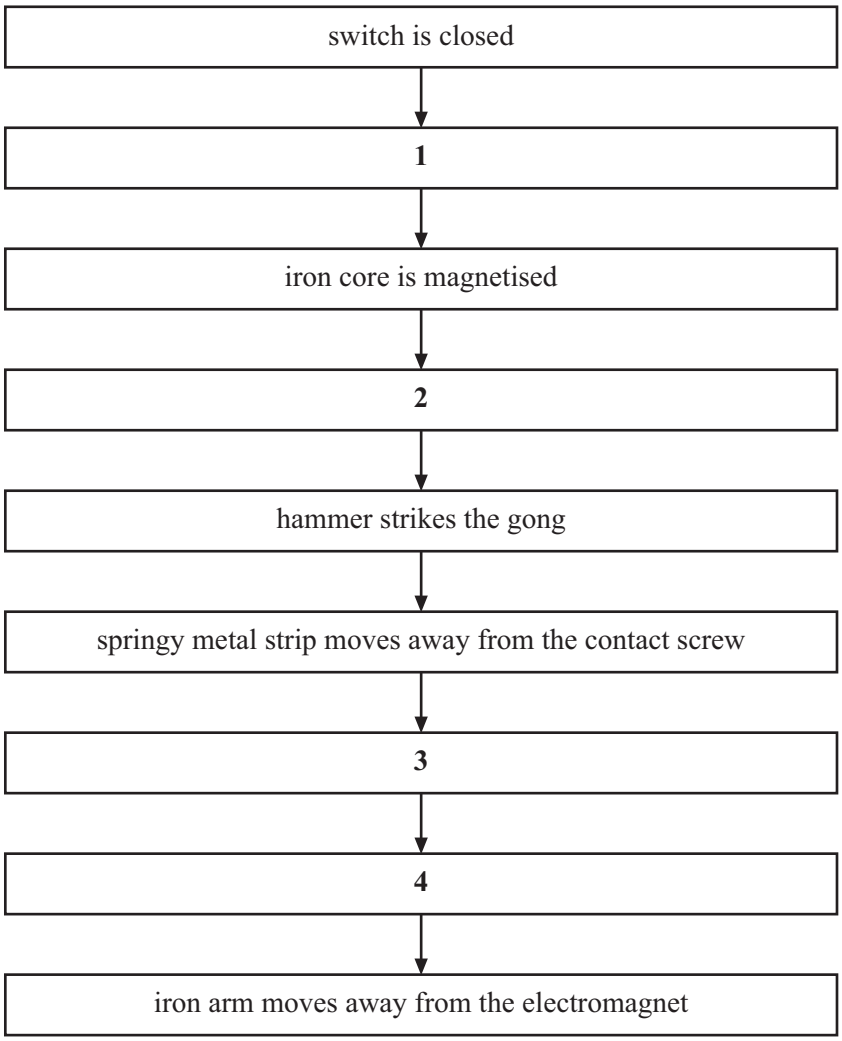
Match statements from the list with the boxes **1–4** on the flow chart.

**circuit is broken**

**current flows through the electromagnet coil**

**electromagnet is no longer magnetised**

**iron arm is attracted to the electromagnet**




**TURN OVER FOR THE NEXT QUESTION**

**QUESTION TWO**

The list shows how the resistance of some components can change.

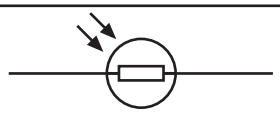
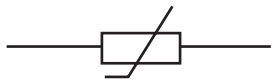
Match phrases **D**, **E**, **F** and **G** in the list with the numbers **1–4** in the table.

**D** **it depends on the direction of the current**

**E** **it increases as the light intensity decreases**

**F** **it increases as the temperature decreases**

**G** **it increases as the temperature increases**

| How the resistance changes | Symbol of component |
|---|---|
| **1** |  |
| **2** |  |
| **3** |  |
| **4** |  |

**NO QUESTIONS APPEAR ON THIS PAGE**

**TURN OVER FOR THE NEXT QUESTION**

**SECTION B**

Questions **THREE** and **FOUR**.

In these questions choose the best **two** answers.

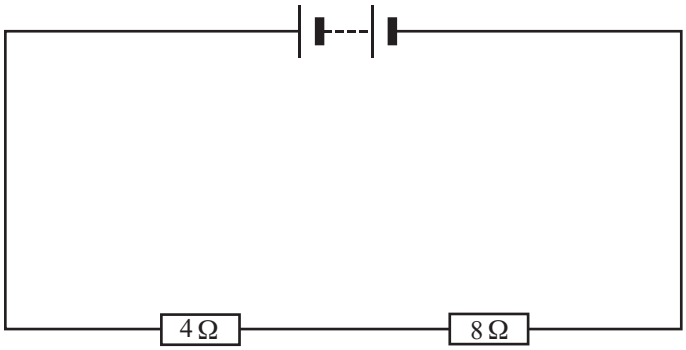
Do **not** choose more than two.

Mark your choices on the answer sheet.

**QUESTION THREE**

A 4 Ω resistor is connected in series with an 8 Ω resistor.

The circuit is shown below.




Which **two** of the statements **P**, **Q**, **R**, **S** and **T** are correct?

**P** **the current through each resistor is the same**

**Q** **the current through the 4 Ω resistor is twice as big as the current through the 8 Ω resistor**

**R** **the potential difference (voltage) across the 4 Ω resistor is twice as big as that across the 8 Ω resistor**

**S** **the potential difference across each resistor is the same**

**T** **the total resistance is 12 Ω**

**QUESTION FOUR**

This question is about the mains electricity supply in the UK.

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

**J** **the earth wire is connected to the live terminal of a plug**

**K** **the fuse in a plug should have a lower value than the normal current flowing through the appliance**

**L** **the live terminal of the supply alternates between positive and negative voltages**

**M** **the neutral terminal of the supply stays at a voltage close to zero with respect to earth**

**N** **the mains supply is d.c. and stays at a constant voltage**

**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**

When insulating materials are rubbed against each other, they may become electrically charged.

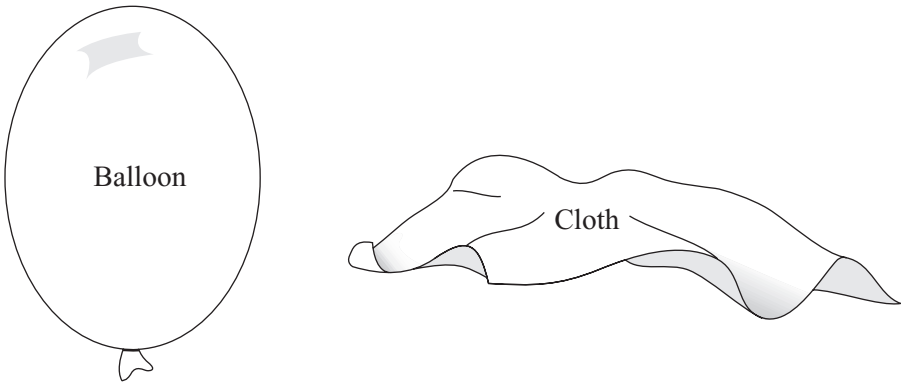



**Figure 1**

**5.1** The balloon rubbed on the cloth has become negatively charged because the balloon . . . . .

**A** attracts electrons from the air which stick to it.

**B** attracts protons from the cloth which stick to it.

**C** gains electrons transferred from the cloth by friction.

**D** repels electrons from its surface.

Electrostatic charges can be useful in everyday life.

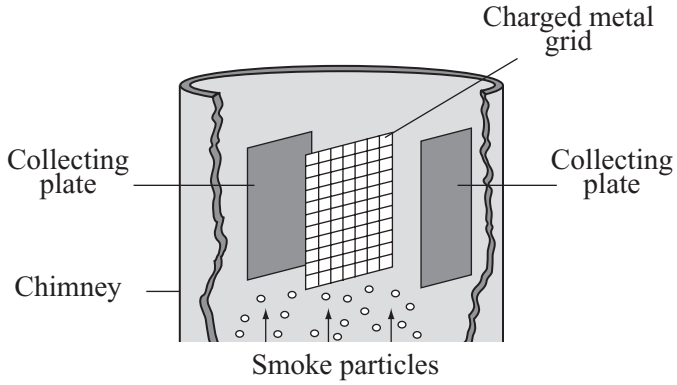



**Figure 2**

**5.2** **Figure 2** shows a . . . . .

**A** smoke detector.

**B** smoke electrode.

**C** smoke precipitator.

**D** smoke screen.

**5.3** As they travel upwards, smoke particles . . . . .

**A** are repelled downwards by the grid.

**B** become trapped in the grid.

**C** gain charge from the grid and are attracted to the plates.

**D** remain neutral and are attracted to the plates.

**5.4** The smoke particles are cleaned out of the equipment by . . . . .

**A** knocking the grid.

**B** knocking the plates.

**C** putting a charge on the chimney.

**D** reversing the charge on the grid.

**QUESTION SIX**

**Figure 1** shows a conductor **X Y**, in a magnetic field.
When the switch is closed, there is a force on the conductor **X Y**.

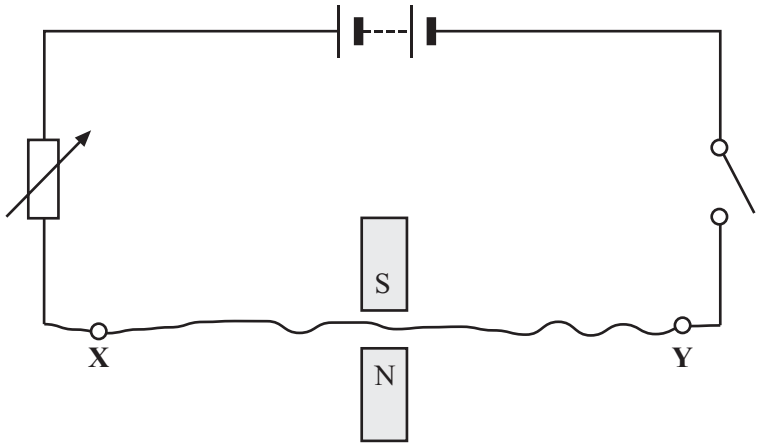



**Figure 1**

**6.1** Which line in the table gives changes which are **certain** to increase the **size** of the force?

| | **Current** | **Strength of magnetic field** |
|---|---|---|
| **A** | decreased | decreased |
| **B** | decreased | increased |
| **C** | increased | decreased |
| **D** | increased | increased |

**6.2** Which line in the table gives changes which will **not** change the **direction** of the force?

| | **Current** | **Magnetic field** |
|---|---|---|
| **A** | decreased | reversed |
| **B** | increased | reversed |
| **C** | reversed | decreased |
| **D** | reversed | reversed |

**6.3** Which of the following is based on a force acting on a conductor in a magnetic field?

**A** A battery

**B** A motor

**C** A thermistor

**D** A transformer

**6.4** The circuit breaker in **Figure 2** contains an electromagnet.

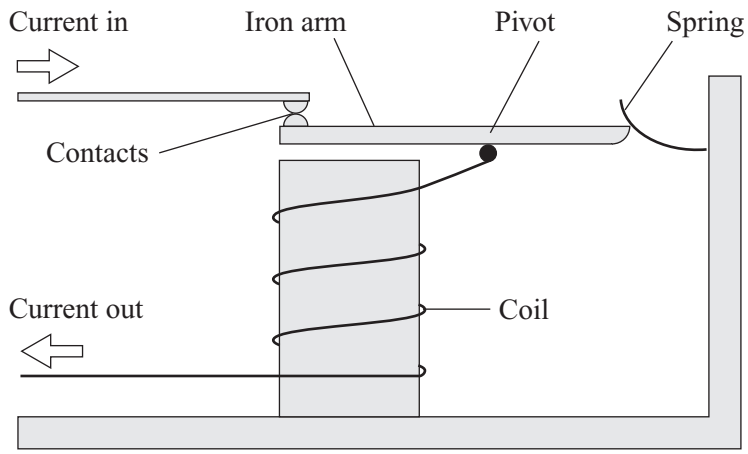



**Figure 2**

When a normal current flows, the contacts touch each other because . . . . .

**A** the contacts have become charged and attract each other.

**B** the electromagnet has attracted them.

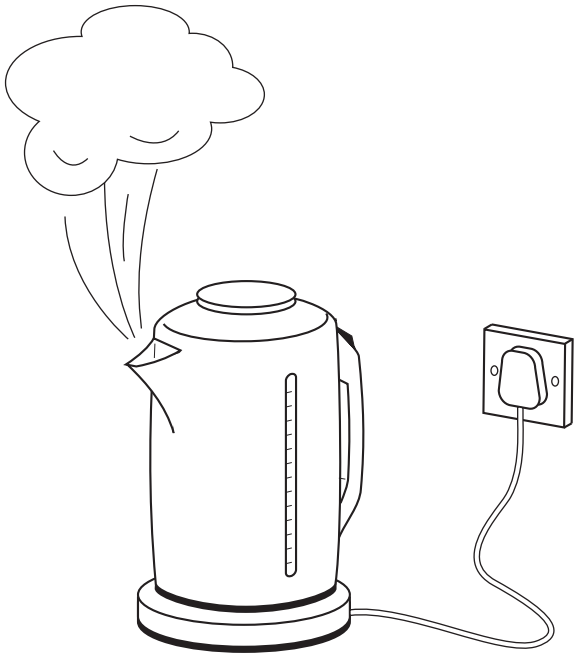
**C** the electromagnet has repelled them.

**D** the electromagnet is too weak to move the iron arm.

**TURN OVER FOR THE NEXT QUESTION**

**QUESTION SEVEN**

The diagram shows an electric kettle connected to the 230 V mains supply.
When the kettle is working normally, the current flowing through it is 10 A.



**7.1** Which formula can be used to calculate the power of the kettle?

**A** $\text{power} = \dfrac{\text{potential difference (voltage)}}{\text{current}}$

**B** $\text{power} = \dfrac{\text{current}}{\text{potential difference}}$

**C** power = potential difference + current

**D** power = potential difference × current

**7.2** The power of the kettle is . . . . .

**A** $\frac{1}{23}$ watt.

**B** 23 watts.

**C** 240 watts.

**D** 2300 watts.

**7.3** The kettle has an earth lead because . . . . .

**A** the handle is made of an insulator and can become charged.

**B** the kettle is made of metal and can become charged.

**C** the kettle is made of metal and can become live.

**D** the lead to the socket is too short.

**7.4** The element of the kettle is a resistor.

Which statement best describes how the kettle works?

**A** When electric charge flows through the element, electrical energy is transferred as heat

**B** When electric charge flows through the element, heat is transferred as electrical energy

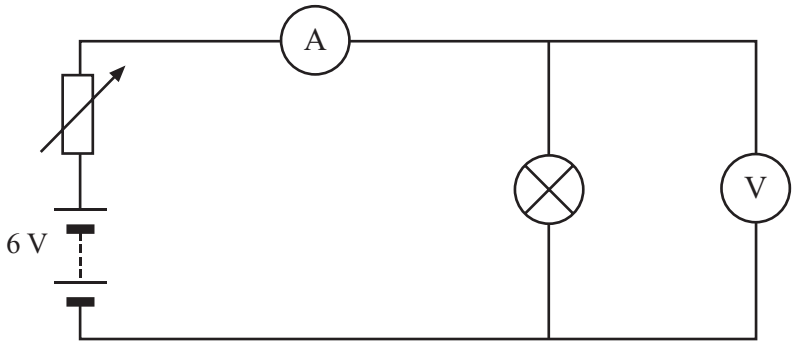
**C** When potential difference (voltage) flows through the element, electrical energy is transferred as heat

**D** When potential difference flows through the element, heat is transferred as electrical energy

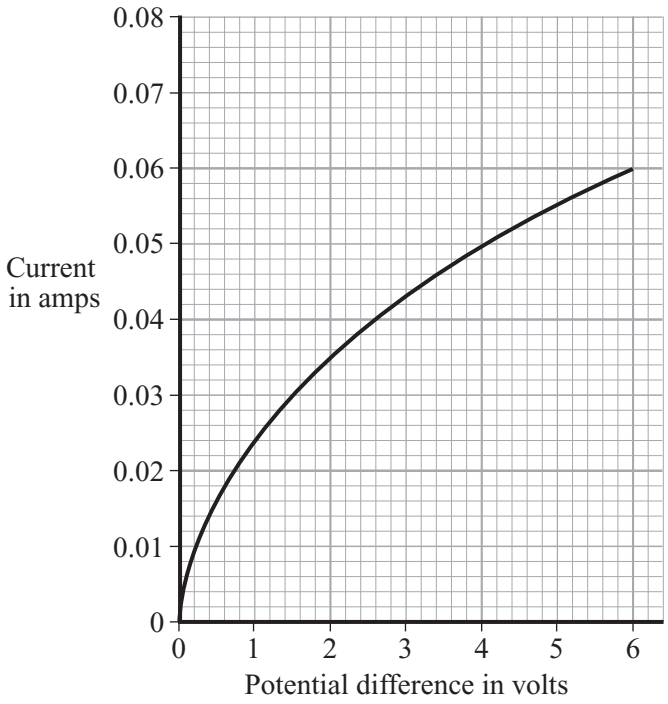
**TURN OVER FOR THE NEXT QUESTION**

**QUESTION EIGHT**

The diagram shows a filament lamp connected to a 6 V supply. Meters are connected so that values of current and potential difference (voltage) can be measured.




The graph of the results is shown.




**8.1** The graph shows that, as the current increases, the resistance of the filament . . . . .

**A** becomes larger and then smaller.

**B** decreases.

**C** increases.

**D** stays the same.

**8.2** When the potential difference across the lamp is 6 V, the resistance of the lamp is . . . . .

**A** 0.01 Ω

**B** 0.1 Ω

**C** 10 Ω

**D** 100 Ω

**8.3** When a current of 0.03 A flows through the filament, the resistance of the lamp is . . . . .

**A** 0.05 Ω

**B** 0.5 Ω

**C** 20 Ω

**D** 50 Ω

**8.4** The circuit shows a voltmeter connected in parallel with the lamp.

The voltmeter will not affect the ammeter readings if it . . . . .

**A** has an internal battery.

**B** has a very large resistance.

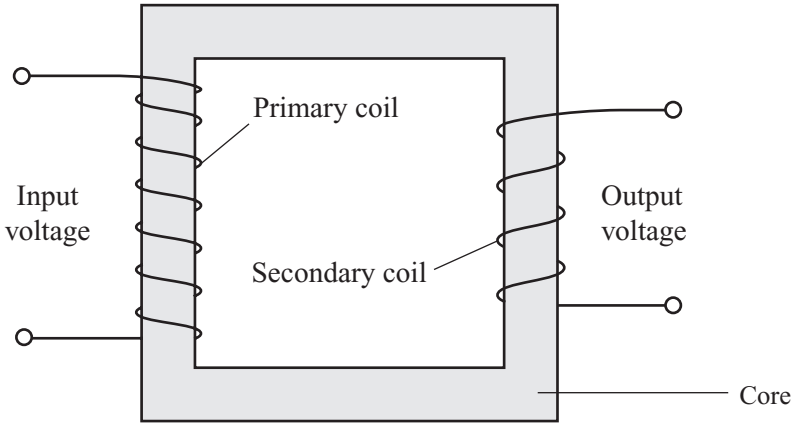
**C** has a very small resistance.

**D** takes sufficient current.

**TURN OVER FOR THE NEXT QUESTION**

**QUESTION NINE**

The diagram shows a simple transformer.




**9.1** Transformers are used between a power station and the National Grid.

This is to . . . . .

**A** increase the voltage so that a higher current can be obtained.

**B** increase the voltage so that less energy is wasted in heating power lines.

**C** reduce the voltage so that a lower current can be obtained.

**D** reduce the voltage so that there is less danger of sparking.

**9.2** To work, a transformer needs . . . . .

**A** a copper core.

**B** a plastic core.

**C** an a.c. input voltage.

**D** a d.c. input voltage.

**9.3** There are 1000 turns on the primary coil and 200 000 turns on the secondary coil of a transformer.

If the input voltage is 200 V, what is the output voltage?

**A** 1 V

**B** 4000 V

**C** 40 000 V

**D** 100 000 V

**9.4** A 46 V lamp needs a current of 3 A.
It is supplied through a transformer connected to the 230 V mains supply.

What is the current through the primary coil?
(Assume there are no power losses in the transformer.)

**A** 0.3 A

**B** 0.6 A

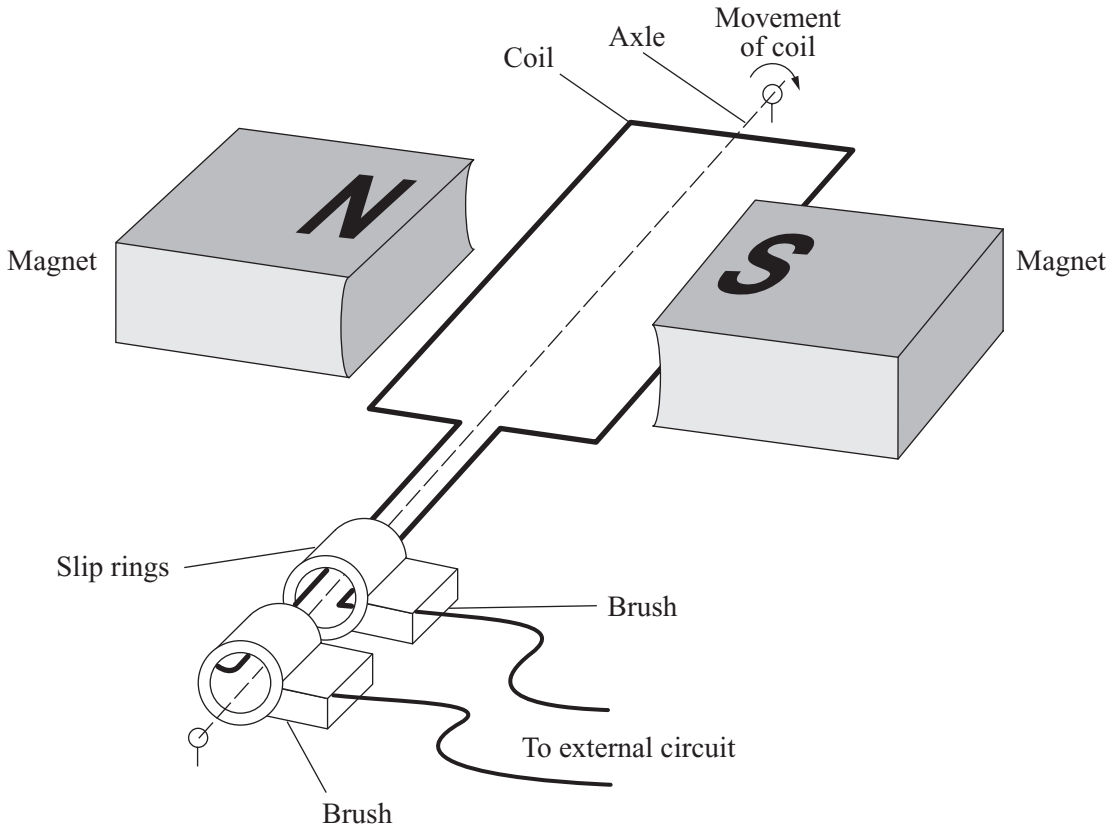
**C** 15.0 A

**D** 16.7 A

**TURN OVER FOR THE NEXT QUESTION**

**QUESTION TEN**

The diagram shows an a.c. generator.




**10.1** Which of the following statements is true?

**A** Increasing the speed of the coil increases the induced voltage but not the output frequency

**B** Increasing the speed of the coil increases the output frequency but not the induced voltage

**C** The induced voltage is zero when the coil is at 90 º to the position shown in the diagram

**D** The induced voltage is zero when the coil is in the position shown in the diagram

**10.2** The slip rings . . . . .

**A** act as insulators.

**B** help the generator go faster by increasing friction.

**C** increase the strength of the magnetic field.

**D** prevent the connecting wires from getting tangled up.

**10.3** The carbon brushes . . . . .

**A** act as brakes to slow down the coil.

**B** act as insulators.

**C** increase the strength of the magnetic field.

**D** provide a good continuous electrical connection.

**10.4** The a.c. from the generator is changed to d.c. This steady current is passed through a component for 5 minutes. In this time, 600 C flow through the component.

What current flows through the component?

**A** 0.008 A

**B** 0.5 A

**C** 2 A

**D** 120 A

**END OF TEST**

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